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MEDICAL ENTOMOLOGY STUDIES.

- VII. THE SUBGENUS *STEGOMYIA* OF *AEDE*
IN SOUTHEAST ASIA.
II - THE *EDWARDSI* GROUP OF SPECIES.
III - THE *W-ALBUS* GROUP OF SPECIES.
(DIPTERA: CULICIDAE).
- VIII. NOTES ON THE TAXONOMIC STATUS OF
AEDE VITTATUS.
(DIPTERA: CULICIDAE).

by

Yiau-Min Huang

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MEDICAL ENTOMOLOGY STUDIES - VII.

THE SUBGENUS *STEGOMYIA* OF *AEDES* IN SOUTHEAST ASIA.

II - THE *EDWARDSI* GROUP OF SPECIES.

III - THE *W-ALBUS* GROUP OF SPECIES.

(DIPTERA: CULICIDAE)¹.

By

Yiau-Min Huang²

ABSTRACT

The *edwardsi* group and the *w-albus* group of the subgenus *Stegomyia* Theobald, genus *Aedes* Meigen, are characterized. The diagnostic characters for distinguishing these groups from other *Stegomyia* are given. Keys to the identification of the species are provided. Information on the present status of the *edwardsi* group of species and the *w-albus* group of species are summarized in appendices A and B.

The *w-albus* group is divided further into new subgroups. Four subgroups (*annandalei*, *desmotes*, *mediopunctatus* and *w-albus*) are recognized and defined, and their relationships are discussed.

Aedes horishensis Yamada is regarded as a variety of *annandalei* Theobald, *perplexus* Leicester is elevated to specific status, *submediopunctatus* Barraud, *sureilensis* Barraud and *mediopunctatus* var. *perplexus* Knight and Hull are shown to be synonyms of *mediopunctatus* Theobald, *minutissima* Theobald and *indosinensis* Borel are recognized as synonyms of *imitator* Leicester and *imitator* Leicester is treated as a subspecies of *gardnerii* Ludlow.

All the known stages of the 11 Southeast Asian species and subspecies, 2 of which species are in the *edwardsi* group and 9 species and subspecies in the *w-albus* group, are redescribed and illustrated. Information on type-data, distribution, biology and a taxonomic discussion of all 11 species and subspecies are presented.

The female and larva of *craggi*, the pupae of 3 species (*craggi*, *mediopunctatus* and *gardnerii*), and the female terminalia of 8 species (*edwardsi*, *annandalei*, *craggi*, *desmotes*, *mediopunctatus*, *perplexus*, *gardnerii* and *w-albus*) are described and illustrated for the first time. The female terminalia of *gardnerii imitator* are described for the first time.

¹

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²

Medical Entomology Project, Department of Entomology, Smithsonian Institution, Washington, D. C. 20560.

New records of 4 species and subspecies are: *craggi* from Thailand, *g. gardnerii* from Sabah, *w-albus* from Thailand and Vietnam, and *gardnerii imitator* from Hong Kong and Cambodia.

INTRODUCTION

The *w-albus* group (Edwards' Group B) is one of the most difficult in the subgenus *Stegomyia*. The group has not been properly defined since Edwards' (1932) classification and this has resulted in the assignment of some incorrect species to it. This study clarifies the situation and also offers a better system of classification.

Due to the extreme complexity and highly variable nature of the group, this study has been handicapped by the lack of adequate material such as progeny rearings from single females of certain species and by the lack of specimens from several important areas.

This paper deals with 2 species groups, the *edwardsi* group and the *w-albus* group. *Aedes (Stegomyia) edwardsi* (Barraud) was originally assigned to Group B (*w-albus* group) by Edwards (1932). Belkin (1962) removed *edwardsi* from Group B and defined a new group (*edwardsi* group) for it and its relatives. Two species of the *edwardsi* group and 9 species and subspecies of the *w-albus* group which are definitely known to occur in the Southeast Asia area are treated here.

This study was based primarily on specimens initially accumulated by the U. S. National Museum (USNM) and later augmented by The Southeast Asia Mosquito Project and the Medical Entomology Project. Additional material was borrowed from the following institutions: Bernice P. Bishop Museum, Honolulu; Field Museum of Natural History, Chicago; University of Utah; Johns Hopkins University School of Hygiene and Public Health; California Academy of Sciences; Medical Zoology Laboratory, The Institute of Medical Science, University of Tokyo; British Museum (Natural History) and the Instituut voor Tropische Hygiene, Amsterdam.

All the type-specimens of the included species which are in the British Museum (Natural History), the U. S. National Museum and the Department of Parasitology, The Institute of Medical Science, University of Tokyo, have been studied.

The nomenclature chosen for the chaetotaxy of the larva and pupa and the terminology of structural parts of the adult as used in this paper largely follows that of Belkin (1962).

An asterisk (*) following the abbreviations used (σ = male, ♀ = female, P = pupa, L = larva and E = egg) indicates that all or some portion of that sex or stage is illustrated. Abbreviations used for the references to the literature conform to the BIOSIS List of Serials, Biosciences Information Service of Biological Abstracts, Philadelphia, 1974.

Distribution records are indicated as follows: Country names are in capital letters, administrative divisions, where known, are in italics and place names have the first letter capitalized. Place names which could not be located in the gazetteers available are spelled according to the labels on the specimens. The letters, l = larval skin, p = pupal skin and L = whole 4th instar larva.

The information on the breeding habitats and the distribution presented in this paper are based entirely on the specimens which I examined.

The *edwardsi* species group and the *w-albus* species group are character-

ized. Four subgroups of the *w-albus* group are recognized and defined, and their relationships are discussed. All the known stages of the 11 Southeast Asian species and subspecies, of which 2 are in the *edwardsi* group and 9 are in the *w-albus* group are redescribed and illustrated, and a number of previously unknown stages are dealt with for the first time. Three new synonyms are recognized, one subspecies is elevated to species rank, and several species are recorded for the first time from certain areas. Keys to the identification of the species are provided. Information on the present status of the *edwardsi* group of species and the *w-albus* group of species are summarized in appendices A and B.

The term "Southeast Asia" as used in this review is as given in the initial paper in this series on the *scutellaris* group of species (Huang 1972b).

In order to verify distributional records, all available specimens, even if from beyond the confines of Southeast Asia, have been examined, as may be seen in the distribution of the *w-albus* group and the *annandalei*, *desmotes*, *mediopunctatus*, *w-albus* subgroups (MAPS II, III, IV, V and VI).

THE *Aedes (Stegomyia) edwardsi* GROUP IN SOUTHEAST ASIA

The Southeast Asia *edwardsi* group is characterized by the following combination of characters.

MALE. Head. Proboscis dark scaled, without pale scales on ventral side, slightly longer than forefemur; palpus dark, slightly shorter than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales on inner side only; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a patch of broad white scales at anterior median area, with broad dark ones on posterior and on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. **Thorax.** Scutum with narrow dark scales and a prominent small median oval white spot of narrow scales on anterior third of scutum; a few narrow yellowish pale scales on lateral margin just before level of wing root; acrostichal bristles absent; dorsocentral bristles present; scutellum with broad white scales on all lobes and with a few broad dark ones at the apex of midlobe; anterior pronotum with broad white scales; posterior pronotum with a small patch of broad white scales on posterior portion and without dark narrow ones dorsally; paratergite with broad white scales; postspiracular area without scales; subspiracular area without scales; patches of broad white scales on propleuron, on the upper and lower portions of sternopleuron and on the upper and lower portions of mesepimeron; upper sternopleural scale patch does not reach to anterior corner of sternopleuron; lower mesepimeral scale patch small and separated from upper mesepimeral scale patch; lower mesepimeron with bristles; metameron bare. **Wing.** With dark scales on all veins except for a minute basal spot of white scales on costa. **Halter.** With dark scales. **Legs.** Coxae with patches of white scales; knee-spots present on all femora; fore- and midfemora anteriorly dark; hindfemur anteriorly with a broad white longitudinal stripe which widens at base and is separated from apical white scale patch; all tibiae anteriorly dark; fore- and midtarsi with basal white bands on tarsomeres 1, 2; hindtarsus with basal white bands on tarsomeres 1-4, tarsomere 5 all white; fore- and midlegs with tarsal claws unequal, larger one toothed, smaller one simple; hindleg with tarsal claws equal, simple.

Abdomen. Segment I with white scales on laterotergite; terga II, III with basal lateral white spots; terga IV-VII with subbasal lateral white spots; sternum II largely covered with white scales; sterna III-VII each with a basal white band; sternum VIII largely covered with white scales. *Terminalia.* Basimere about 3 times as long as wide; its scales restricted to lateral and ventral areas; with a patch of setae on basomesal area of dorsal surface; mesal surface membranous; claspette well developed, with numerous setae; distimere simple, elongate, about 0.86 as long as basimere, with a spiniform process and a few setae at apex; aedeagus widened apically, with 6 or 7 apical teeth on each side; paraprocts without teeth; cercal setae absent; tergum IX with middle part produced into a large rounded lobe and with a hairy lobe on each side.

FEMALE. Essentially as in male, differing in the following respects:

Head. Proboscis as long as forefemur; palpus 5-segmented, segment 5 minute, about 0.25 of proboscis, with white scales on less than apical half. *Thorax.* Posterior pronotum with a small patch of broad white scales on posterior portion and with or without dark narrow ones dorsally; subspiracular area with or without scales; lower mesepimeron with or without bristles; mesepimeral scale patches connected or separated. *Legs.* Fore- and midlegs with tarsal claws equal, simple. *Abdomen.* Terga II-VI with or without basal submedian lateral white spots, in addition to the usual basal lateral white spots; tergum VII with subbasal lateral white spots and with or without a medial subbasal spot; segment VIII largely to completely retracted. *Terminalia.* Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 3 longer ones on apical 0.25-0.33; tergum IX with well developed lateral lobes, each with 3-5 setae; post-genital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

DISTRIBUTION. The Southeast Asia members of the *edwardsi* group are known only from the Oriental area of Belkin (1962) (MAP I).

TAXONOMIC DISCUSSION. The *edwardsi* group was erected by Belkin (1962) for the nominate species *edwardsi* (Barraud) 1923 from Andaman Islands, *tulagiensis* Edwards 1926 and *robinsoni* Belkin 1962 from Santa Cruz Islands, South Pacific and the unnamed form from Saigon provisionally identified as *edwardsi* by Borel (1928).

My concept of the *edwardsi* group is the same as that of Belkin (1962), with the addition of a 4th species, *seampi* Huang 1974 from the Andaman Islands.

The *edwardsi* group shows the strongest affinities with the *scutellaris* group but can easily be separated from it by the scutal markings which are much reduced. The immature stages of the Southeast Asia *edwardsi* are unknown. Gaps in our knowledge of this group and the need for material from entire Oriental region, particularly material from Andaman Islands are obvious.

Based on the present collection data, all the members of the *edwardsi* group in Southeast Asia occur in the Oriental region while members of the South Pacific *edwardsi* occur in Santa Cruz Islands. The remarkable discontinuous distribution of the group may be altered by the discovery of forms in intermediate areas. However, it is possible that this is a relict group with no other representatives surviving as indicated by Belkin (1962: 445).

BIONOMICS. Nothing is known about the biology of the species of Southeast Asia *edwardsi*. In the South Pacific, the immature stages of *tulagiensis* have been collected in a pandanus leaf axil and a tree hole (Belkin 1962: 447); the immature stages of *robinsoni* have been collected in a tree fern stump and in a large tree hole in a poinciana tree (Belkin 1962: 448).

MEDICAL IMPORTANCE. Nothing is known of the disease relations of members of this group.

KEYS TO THE SPECIES OF THE *EDWARDSI* GROUP

The *edwardsi* group of species, including those not yet recorded from Southeast Asia, can be distinguished from other *Stegomyia* by the following combination of characters: palpi with white scales; scutum with a prominent small median oval white spot of narrow scales on anterior third of scutum, and dorsocentral bristles present; scutellum with broad white scales on all lobes; hindtarsus with basal white bands on tarsomeres 1-4, tarsomere 5 all white.

MALES AND FEMALES¹

1. Posterior pronotum without narrow dark scales on upper portion; lower mesepimeron with bristles (Fig. 4C). *edwardsi* (p. 6)
- Posterior pronotum with narrow dark scales on upper portion; lower mesepimeron without bristles (Fig. 4F). 2
- 2(1). Abdomen with basal submedian lateral white spots on terga II-VI in addition to the basal lateral white spots (Fig. 4D). *seampi* (p. 7)
- Abdomen without basal submedian lateral white spots on terga II-VI, with basal lateral white spots only (Fig. 4A). 3
- 3(2). Hind tarsomere 4 with white scales on more than basal half. *tulagiensis* 2
- Hind tarsomere 4 with white scales on less than basal half. *robinsoni* 2

MALE TERMINALIA

1. Tergum IX with middle part produced into a large lobe (Fig. 1C). *edwardsi* (p. 6)
- Tergum IX with middle part evenly rounded. 2
- 2(1). Claspette with a long sternal fingerlike process bearing more than 12 setae. *tulagiensis* 2
- Claspette with a short sternal process bearing about 3 setae. *robinsoni* 2

¹

The male of *seampi* and the female of *robinsoni* are unknown.

²

South Pacific species.

DESCRIPTIONS OF THE SPECIES

AEDES (STEGOMYIA) EDWARDSI (BARRAUD)

(Figs. 1; 2; 3A, B, C, D; 4A, B, C)

Stegomyia edwardsi Barraud 1923a: 784 (♂*, ♀*); ?Borel 1928; 7: 98.*Aedes (Stegomyia) edwardsi* (Barraud), Edwards 1932: 164; Barraud 1934: 232 (♂*, ♀*).

MALE (Fig. 1A). *Head*. Proboscis dark scaled, without pale scales on ventral side, slightly longer than forefemur; palpus dark, slightly shorter than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender and upturned and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales on inner side only; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a patch of broad white scales at anterior median area, with broad dark ones on posterior and on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax* (Fig. 4C). Scutum with narrow dark scales and a prominent small median oval white spot of narrow scales on anterior third of scutum; a few narrow yellowish pale scales on lateral margin just before level of wing root; acrostichal bristles absent; dorsocentral bristles present; scutellum with broad white scales on all lobes and with a few broad dark ones at the apex of midlobe; anterior pronotum with broad white scales; posterior pronotum with a small patch of broad white scales on posterior portion; paratergite with broad white scales; postspiracular area without scales; subspiracular area without scales; patches of broad white scales on propleuron, on the upper and lower portions of sternopleuron and on the upper and lower portions of mesepimeron; upper sternopleural scale patch does not reach to anterior corner of sternopleuron; lower mesepimeral scale patch small and separated from upper mesepimeral scale patch; lower mesepimeron with 2 bristles, between the 2 mesepimeral scale patches; metameron bare. *Wing*. With dark scales on all veins except for a minute basal spot of white scales on costa; cell R_2 1.5 times as long as R_{2+3} . *Halter*. With dark scales. *Legs*. Coxae with patches of white scales; knee-spots present on all femora; fore- and midfemora anteriorly dark; hindfemur anteriorly with a broad white longitudinal stripe on about the basal half; all tibiae anteriorly dark; fore- and midtarsi with basal white bands on tarsomeres 1, 2; hindtarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to the total length of tarsomere is 0.25, 0.33, 0.40 and 0.50; tarsomere 5 all white; fore- and midlegs with tarsal claws unequal, the larger one toothed, the smaller one simple; hindleg with tarsal claws equal, simple. *Abdomen*. Segment I with white scales on laterotergite; terga II, III with basal lateral white spots; terga IV-VII with subbasal lateral white spots; sternum II largely covered with white scales; sterna III-VII each with a basal white band; sternum VIII largely covered with white scales. *Terminalia* (Fig. 1C). Basimere about 3 times as long as wide; its scales restricted to lateral and ventral areas; with a patch of setae on basomesal area of dorsal surface; mesal surface membranous; claspette large, long, reaching to 0.66 of basimere, with numerous setae; distimere simple, elongate, about 0.86 as long as basimere, with a spiniform process and a few setae at apex;

aedeagus widened apically, with 6 or 7 apical teeth on each side; paraprocts without teeth; cercal setae absent; tergum IX with middle part produced into a large rounded lobe and with a hairy lobe on each side.

FEMALE. Essentially as in male, differing in the following respects:

Head (Figs. 3A, B). Proboscis as long as forefemur; palpus 5-segmented, segment 5 minute, about 0.25 of proboscis, with white scales on less than apical half. **Wing.** With cell R_2 about twice as long as R_{2+3} . **Legs.** Hindfemur anteriorly with a broad white longitudinal stripe on about the basal 0.6; hind-tarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to the total length of tarsomere is 0.25, 0.33, 0.40 and 0.67; fore- and midlegs with tarsal claws equal, simple. **Abdomen** (Figs. 4A, B). Segment VIII completely retracted. **Terminalia** (Fig. 2). Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 3 longer ones on apical 0.25; tergum IX with well developed lateral lobes, each with 3-5 setae; postgenital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA AND LARVA. Unknown.

TYPE-DATA. *Stegomyia edwardsi* Barraud, holotype male with associated terminalia slide (YMH-'68 -36), allotype female, in British Museum (Natural History), London (BMNH); type-locality: Andaman Islands, IX-1911 (S. R. Christophers).

DISTRIBUTION. 19 specimens examined: 6♂, 5♀, 6♂ terminalia, 2♀ terminalia.

INDIA. *Andaman Islands:* (IX-1911, S. R. Christophers), 2♂, 2♀, 2♂ terminalia; (1926, G. Covell), 4♂, 3♀, 4♂ terminalia, 2♀ terminalia.

TAXONOMIC DISCUSSION. The adult of *edwardsi* can easily be distinguished from that of all other members of the *edwardsi* group by the presence of lower mesepimeral bristles and by the absence of narrow dark scales on the upper portion of the posterior pronotum.

The male terminalia of this species have the claspette large, long, reaching to 0.66 of the basimere, with numerous setae and tergum IX with the middle part produced into a large rounded lobe and with a hairy lobe on each side which differ from all other species described in this group.

Aedes edwardsi, an Oriental species of the *edwardsi* group, is here recorded from the Andaman Islands only. I have not seen the Saigon material mentioned by Borel (1928). The Indochina record of Stone et al. (1959) was apparently based upon the earlier Borel (1928) citation.

BIONOMICS. Unknown.

AEDES (STEGOMYIA) SEAMPI HUANG (Figs. 3E; 4D, E, F; 5)

Aedes (Stegomyia) seampi Huang 1974c: 137 (♀*).

MALE. Unknown.

FEMALE. **Head.** Proboscis dark scaled, without pale scales on ventral side, as long as forefemur; palpus about 0.25 length of proboscis, with white scales on less than apical half; antenna shorter than proboscis; clypeus bare; torus covered with white scales on inner side only; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a patch of broad white scales at anterior median area, with broad dark ones on posterior and on each side interrupted by a lateral

stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax* (Fig. 4F). Scutum with narrow dark scales and a prominent small median oval white spot of narrow scales on anterior third of scutum; a few narrow yellowish scales on lateral margin just before level of wing root; acrostichal bristles absent; dorsocentral bristles present; scutellum with broad white scales on all lobes and with a few broad dark ones at the apex of midlobe; anterior pronotum with broad white scales; posterior pronotum with a small patch of broad white scales on posterior portion and with a few narrow dark scales on upper portion; paratergite with broad white scales; postspiracular area without scales; subspiracular area with scales; patches of broad white scales on propleuron, on the upper and lower portions of sternopleuron and on the upper and lower portions of mesepimeron; upper sternopleural scale patch does not reach to anterior corner of sternopleuron; upper and lower mesepimeral scale patches connected; lower mesepimeron without bristles; metameron bare. *Wing*. With dark scales on all veins except for a minute basal spot of white scales on costa; cell R_2 about twice as long as R_{2+3} . *Halter*. With dark scales. *Legs*. Coxae with patches of white scales; knee-spots present on all femora; fore- and midfemora anteriorly dark; hindfemur anteriorly with a broad white longitudinal stripe on about the basal 0.6; all tibiae anteriorly dark; fore- and midtarsi with basal white bands on tarsomeres 1, 2; hindtarsus with basal white bands on tarsomeres 1-4, the ratio of length of white band to the total length of tarsomere is 0.25, 0.33, 0.40 and 0.60; tarsomere 5 all white; fore-, mid- and hindlegs with tarsal claws equal, simple. *Abdomen* (Figs. 4D, E). Segment I with white scales on laterotergite; terga II, III with basal lateral white spots; terga IV-VII with subbasal lateral white spots; in addition, terga II-VI with basal submedian lateral white spots and tergum VII with a medial subbasal white spot not connected with the lateral spots; sterna III-VI with a basal white band; segment VIII largely retracted. *Terminalia* (Fig. 5). Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 3 longer ones on apical third; tergum IX with well developed lateral lobes, each with 4 setae; postgenital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA and LARVA. Unknown.

TYPE-DATA. *Aedes (Stegomyia) seampi* Huang, holotype female, in BMNH; type-locality: ANDAMAN ISLANDS, 1926 (G. Covell). Paratype: 1♀, with associated terminalia slide (73/292), with same data as holotype, in U. S. National Museum, Washington, D. C. (USNM).

DISTRIBUTION. 3 specimens examined: 2♀, 1♀ terminalia.

INDIA. *Andaman Islands*: (1926, G. Covell), 2♀, 1♀ terminalia.

TAXONOMIC DISCUSSION. *Aedes seampi* is a member of the *edwardsi* group, having palpi with white scales, scutum with a prominent small median oval white spot of narrow scales on the anterior third of the scutum, and dorsocentral bristles present. The female differs from that of *edwardsi* in the presence of narrow dark scales on the upper portion of the posterior pronotum and by the absence of lower mesepimeral bristles. In this respect, *seampi* is very similar to the 2 South Pacific species (*tulagiensis* and *robinsoni*) of the *edwardsi* group. However, it can easily be distinguished from all other members of the group by the presence of basal submedian lateral white spots on each of terga II-VI, in addition to the basal lateral white spots.

Aedes seampi, an Oriental species of the *edwardsi* group, is presently known only from the Andaman Islands.

BIONOMICS. Unknown.

THE *Aedes (Stegomyia) w-albus* GROUP IN SOUTHEAST ASIA

The Southeast Asia *w-albus* group is characterized by the following combination of characters.

MALE. *Head.* Proboscis dark scaled, with or without a white patch at base, and with or without some pale scales on ventral side, as long as or slightly longer than forefemur; palpus dark, as long as to considerably longer than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; sometimes segment 5 with white basal band on ventral side very small or without white basal band; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, as long as or shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side, or sometimes with white scales on dorsal side as well; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a median stripe, or a broad median stripe, or a median patch of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax.* Scutum with narrow dark scales and a large median white patch, or a broad median longitudinal white stripe, or 2 lateral longitudinal white stripes, or 2 lateral white patches of narrow scales on anterior third or more of scutum; with or without narrow white scales on the anterior prescutal area and on the lateral prescutal area; there is on each side a large patch of broad white scales on the lateral margin just before the level of the wing root and above the paratergite, or an antealar white patch of narrow, or narrow and broad scales present; a posterior dorso-central white line present and well developed, to absent; a prescutellar white line present and well developed, to absent; with or without a patch of broad dark scales on each side of prescutellar space and a patch of broad dark scales over the wing root and toward scutellum; acrostichal and dorsocentral bristles absent; prescutellar bristles absent to present and well developed; scutellum with broad dark scales on midlobe and broad white scales on lateral lobe, or scutellum with broad white scales on midlobe and broad dark scales on lateral lobe, sometimes lateral lobe with few pale broad scales as well, occasionally lateral lobe with all pale broad scales, or scutellum with broad white scales on all lobes; anterior pronotum with broad white scales; posterior pronotum with broad white scales and some dark broad or narrow ones dorsally, or with some white narrow ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the subspiracular and postspiracular areas, on the upper and lower portions of sternopleuron and on the mesepimeron; hypostigial, prealar and metameron areas with or without broad white scales; upper sternopleural scale patch and prealar scale patch connected or separated; lower mesepimeron without bristles. *Wing.* With dark scales on all veins, with or without a minute basal spot of white scales on costa. *Halter.* With dark scales. *Legs.* Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; forefemur anteriorly dark, with or without a basoventral white line; midfemur anteriorly dark, with or without a median white spot on anterior surface, or midfemur with 2 white spots on anterior surface; hindfemur anteriorly with basal 0.67-0.75 white, a complete dark band present and separates the basal white stripe from the apical white scale patch, or a triangular dark patch present and separates the basal white stripe from the apical white scale patch except on the lower portion of anterior surface; all tibiae anteriorly dark, with or without a white band; hindtibia with

or without a white stripe on basoventral 0.25; fore- and midtarsi with basal white band on tarsomere 1, or on tarsomeres 1,2; midtarsus with or without basal white band on tarsomere 3; hindtarsus with basal white bands on tarsomeres 1,2; tarsomere 3 with basal white band or all dark; tarsomeres 4,5 all white, or with basal white band to all dark; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Segment I with white scales on laterotergite; terga II-VI with basal lateral white spots; tergum II dark dorsally, or sometimes with a small basal median white spot, or sometimes with a basal white band; tergum III with or without a basal white band; terga IV-VI each with a basal or subbasal white band which is, or is not connected with the lateral spots; tergum VII without or with lateral white spots only, or sometimes tergum VII with a basal white band as well; sterna III-VI with basal white bands, or sometimes sternum III largely covered with white scales; sternum VIII largely covered with white scales. *Terminalia*. Basimere 2 to 3 times as long as wide; its scales restricted to dorsolateral, lateral and ventral areas, or lateral and ventral areas; without or with few to a patch of setae on basomesal area of the dorsal surface; claspette well developed, with numerous setae and without or with some specialized ones; distimere simple, elongate, 0.7 to slightly longer than basimere, with setae and a spiniform process near apex or subapically, or distimere complex, slightly shorter than basimere, expanded at base and forked apically, with setae and spiniform process; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct with or without ventral arms; cercal setae absent; tergum IX with middle part concave, nearly flat, or produced into a lobe and with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects: *Head*. Palpus 4-segmented, or 5-segmented, segment 5 minute, about 0.25 of proboscis, with white scales on less than apical half. *Legs*. Fore- and midlegs with tarsal claws equal, all toothed. *Abdomen*. Tergum VII with lateral white spots and basal or subbasal white band which is not connected with the lateral spots; tergum VIII sometimes with lateral white spots and basal white band which is not connected with the lateral white spots; segment VIII not retracted to completely retracted. *Terminalia*. Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with some (3-10) larger ones on apical 0.33-0.50; tergum IX slightly, or much broader than long, to slightly longer than broad, with well developed lateral lobes, each with 3-6 setae; postgenital plate with, or sometimes without shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA. *Cephalothorax*. Trumpet short, 2.5 to 3.5 times as long as wide at the middle; seta 1,3-C single or double, longer than 2-C; 6-C single, shorter than 7-C; 10-C with 1-5 branches, mesad and caudad of 11-C; 11-C single, stout. *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2,3-I not widely separated, distance between them same as distance between 4,5-I; 1-II usually branched and dendritic, or sometimes with 2-6 branches; 2-IV, V laterad, or mesad of 1-IV, V. *Paddle*. Margins with fringe; apex rounded or produced; seta 1-P single.

LARVA. *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle, or sometimes before middle of shaft, single, small, spine-like; seta 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C usually single, or sometimes double, long; 6-C with 1-5 branches; 7-C with 1-3 branches; 8-C single; 9-C with 1-3 branches; 10-C single or double; 11-C with 1-4 branches; 12-C with 2-8 branches; 13-C with

1-6 branches; 14-C with 2-3 branches; 15-C with 1-4 branches; mentum with 8-13 teeth on each side. *Thorax*. Seta 1-P with 2-4 branches; 2-P single; 3-P double; 4-P with 1-6 branches; 5-P with 1-3 branches; 6, 9-P usually single (1-2); 7-P single or double; 11-P single; 14-P with 2-3 branches; 5, 7-M single; 6-M with 1-4 branches; 8-M with 2-5 branches; 9-M with 1-3 branches, barbed; 10, 12-M single, long, stout and barbed; 11-M usually single (1-2); 7-T with 2-6 branches; 9-T with 1-3 branches; 10, 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural setae sometimes well developed, long, straight, pointed or blunted at tip. *Abdomen*. Seta 6-I, II with 2-4 branches; 7-I single or double; 7-II with 1-5 branches; 6-III-V single or 2-branched, sometimes one more slender and shorter than the other; 6-VI single or double; 7-III with 2-6 branches, smaller to larger than 9-III; 4-I, II single or with 2-5 branches; 1-VII with 2-4 branches; 2-VII with 1-4 branches; comb of 3-7 scales in a row, arising from a sclerotized plate, or comb of 5-10 scales in a single row and without a sclerotized plate, each scale with fine denticles at the base of the apical spine; sometimes comb scale with apical spine split at tip; seta 2-VIII distant from 1-VIII; 1, 5-VIII with 1-4 branches; 3-VIII with 2-6 branches; 2, 4-VIII single; saddle incomplete; marginal spicules stout and conspicuous, or very fine and inconspicuous; 1-X with 1-4 branches; 2-X with 1-3 branches; 3-X single; ventral brush with 4 pairs of setae on grid, each seta single, sometimes 1 or 2 proximal ones double, or sometimes 4d-X very small and no bars; without precratal tufts; anal papillae about 2 to 3.2 times as long as saddle, sausage-like. *Siphon*. About 1.7 to 3.3 times as long as wide, acus absent; 3-22 pecten teeth, in a straight or irregular row, each tooth with 1-5 basal denticles, or each tooth with or without fine basal denticles, and sometimes transparent distally; 1-S with 2-4 branches, inserted about the level of or before last tooth and dorsad of the teeth, or inserted beyond last tooth and in line with the teeth.

DISTRIBUTION. The Southeast Asia *w-albus* group is confined to the Oriental region. It is found from southwestern India, eastern Pakistan in the west, to the Philippines in the east, from southern China in the north, to Java in the south, to Taiwan in the northeastern corner and to Alor Island in the southeastern corner (MAP II).

TAXONOMIC DISCUSSION. Edwards (1932) divided the subgenus *Stegomyia* into 4 groups which he designated A, B, C and D. In Group B (*w-albus* group) he included 12 species from the Oriental and Palearctic regions, and Mauritius. Mattingly (1953) transferred *Aedes chemulpoensis* Yamada and *Aedes mas-carensis* MacGregor from Group B to Group A (*aegypti* group). Belkin (1962) removed *Aedes edwardsi* from Group B and defined a new group (*edwardsi* group) for it and its relatives. Mattingly (1965) transferred *Aedes mediopunctatus* (Theobald) and *Aedes galloisi* Yamada from Group C (*scutellaris* group) to Group B and assigned *Aedes amaltheus* de Meillon and Lavoipierre to Group B. He subdivided Group B (*w-albus* group) into 3 subgroups known as Subgroup B1 (*w-albus* subgroup) (included species: *annandalei* (Theobald), *craggi* (Barraud), *desmotes* (Giles), *gardnerii* (Ludlow), *mediopunctatus*, *w-albus* (Theobald)), Subgroup B2 (*meronephada* subgroup) (included species: *meronephada* (Dyar and Shannon)), Subgroup B3 (*amaltheus* subgroup) (included species: *amaltheus*, *aurotaeniatus* Edwards, *galloisi*). Huang (1970) removed *Aedes aurotaeniatus* from Group B and placed in the subgenus *Paraedes* Edwards, and (1972a) transferred *galloisi* from Group B back to Group C. Huang (1973) confirmed the assignment of *mediopunctatus* and its relatives to the *w-albus* group, and (1974a) transferred *amaltheus* from Group B to the *aegypti* group and (1974b) confirmed the assignment of *chemulpoensis* to the

aegypti group. *Aedes meronephada* is not a *Stegomyia* and will be treated in a separate paper. The *w-albus* group of the present paper is practically the same complex of species as Mattingly's Subgroup B1.

At present, the *w-albus* group of *Stegomyia* contains 10 species and subspecies. Nine species and subspecies of these, *annandalei*, *craggi*, *desmotes*, *gardnerii gardnerii*, *gardnerii imitator* (Leicester), *malikuli* Huang, *mediopunctatus*, *perplexus* (Leicester) and *w-albus*, are found within the Southeast Asia area and one additional species, *rhungkhiangensis* Chang and Chang 1974 from China, which also occurs in the Southeast Asia area is not treated here since specimens are not available. In addition, there is one form of *w-albus* known but not named from Malaysia (Mattingly 1965: 48). This awaits review until more adequate material is available.

The 10 species and subspecies of the *w-albus* group can be divided further into 4 subgroups, the *annandalei* subgroup (included species: *annandalei*, *craggi*), the *desmotes* subgroup (included species: *desmotes*), the *mediopunctatus* subgroup (included species: *malikuli*, *mediopunctatus*, *perplexus*, *rhungkhiangensis*) and the *w-albus* subgroup (included species and subspecies: *gardnerii gardnerii*, *gardnerii imitator*, *w-albus*). These 4 subgroups all occur in the Southeast Asia area and extend into the western Oriental region.

In the identification of the species of the *w-albus* group, the adult stages appear to be more promising than the immature stages. However, it must be remembered that specific differences between the members of this group tend to be very slight. Some members are highly variable in both adult ornamentation and in the immature stages. Although the males of all species can be recognized on the basis of morphological features, the females and the immatures are extremely difficult or impossible to distinguish in many instances. The male terminalia of all species are distinct and the most diagnostic feature of all is the claspette of the basimere. In dealing with these, special preparations must be made and care taken to study both lateral and mesal views of the dissected claspette as well as undissected aspects.

BIONOMICS. The immature stages have been found mainly in bamboo stumps, bamboo internodes, cut and split bamboos, bamboo cups, tree and log holes, pandanus and nipa palm axils. Females of 6 species and one subspecies, *annandalei*, *craggi*, *desmotes*, *mediopunctatus*, *perplexus*, *w-albus* and *gardnerii imitator*, are known to bite man.

MEDICAL IMPORTANCE. Leicester (1908b: 267) reported that in the laboratory in Malaya, 6 out of 8 *desmotes* and 3 out of 3 *perplexus* became infected with larval stages of "*Filaria nocturna*" (*Wuchereria bancrofti*) after they were fed on a microfilaremic patient. Bailey et al. (1975) reported finding "*desmotes*, *mediopunctatus* and *gardnerii*, caught while biting humans, infected with larvae of an unidentified filaria in Kanchanaburi Province of southwestern Thailand."¹ Although very little has been reported as regarding the medical significance of members of this group, the females of several species attack man readily and can be abundant especially near villages and plantations. They should be considered of potential public health importance.

¹These specimens were probably *perplexus* and *gardnerii imitator*.

KEYS TO THE SPECIES

The *w-albus* group of species can be distinguished from other *Stegomyia* by the following combination of characters: palpi with white scales; scutal markings varied and dorsocentral bristles absent; subspiracular and postspiracular areas with broad white scales; hindtarsus with basal white bands on tarsomeres 1, 2, tarsomere 3 with basal white band or all dark.

MALES AND FEMALES

1. Tibiae with white ring (Fig. 21A).
 (*desmotes* subgroup) *desmotes* (p. 26)
 Tibiae without white ring. 2
- 2(1). Scutellum with broad dark scales on midlobe and with broad white scales on lateral lobe (Figs. 9B, D). . . . (*annandalei* subgroup) 3
 Scutellum with broad white scales on midlobe and with broad dark, or white scales, or both on lateral lobe. 4
- 3(2). Scutum with a large median oval white patch, reaching from anterior margin, narrows slightly posteriorly and to about the middle of the scutum; posterior tip of the scutal patch blunt (Fig. 9B).
 annandalei (p. 17)
 Scutum with a large median triangular white patch, reaching from anterior margin and about anterior half of the lateral prescutal area, narrows posteriorly and to the middle of the scutum; posterior tip of the scutal patch pointed (Fig. 9D). *craggi* (p. 22)
- 4(2). Scutum with a broad median longitudinal white stripe, extending from anterior margin, tapering posteriorly and forking at the beginning of prescutellar space; midfemur without a median white spot on anterior surface (Fig. 25A).
 (*mediopunctatus* subgroup) *malikuli* (p. 33)¹
 mediopunctatus (p. 36)
 perplexus (p. 40)
 Scutum without such a median longitudinal white stripe; midfemur with a median white spot on anterior surface (Fig. 21B).
 (*w-albus* subgroup) 5
- 5(4). Scutum with a broad longitudinal white stripe on either side of midline, reaching from anterior margin to the middle of the scutum and fusing with the antealar white patch (Fig. 17D).
 gardnerii gardnerii (p. 46)
 Scutum with a large median white patch, or 2 lateral white patches, on anterior third of scutum. 6
- 6(5). Scutal median white patch broader than long, with narrow white scales reaching to the lateral prescutal area on each side; antealar white

¹The female of *malikuli* is unknown.

- patch with narrow white scales mainly and with some broad white ones on the lateral margin just before the level of the wing root (Figs. 32B, A). *gardnerii imitator* (p. 50)
- Scutal median white patch rather narrow and long; antealar white patch with all narrow white scales (Figs. 32D, C). *w-albus* (p. 55)

MALE TERMINALIA

1. Paraproct with ventral arms (Fig. 14C). *desmotes* (p. 26)
Paraproct without ventral arms. 2
- 2(1). Tergum IX with a large median lobe (Figs. 19C, 21C, 25C, 29C, 33C). 3
Tergum IX without a median lobe. 7
- 3(2). Distimere simple (Figs. 29C, 33C). 4
Distimere complex (Figs. 19C, 21C, 25C). 5
- 4(3). Claspette with numerous setae on the expanded distal part and occupying about half of it (Fig. 29C). *gardnerii gardnerii* (p. 46)
gardnerii imitator (p. 55)
Claspette with numerous widened setae on the expanded distal part and occupying about 0.67 or more of it (Fig. 33C). *w-albus* (p. 55)
- 5(3). Claspette simple, with numerous long setae on the slightly expanded distal part and with few shorter ones on sternal side (Fig. 19C).
malikuli (p. 33)
Claspette large and bilobed, with numerous setae and with a distinct stout spine-like seta on apicosternal angle of expanded distal part (Figs. 21C, 25C). 6
- 6(5). Claspette with several distinctly long and stout setae on tergal portion of expanded distal part (Fig. 21C). *mediopunctatus* (p. 36)
Claspette without several distinctly long and stout setae on tergal portion of expanded distal part (Fig. 25C). *perplexus* (p. 40)
- 7(2). Claspette large, with 3 widened, leaf-like setae on tergal side and with 2 stout, spine-like setae on sternal side of expanded distal part, with several slender setae scattered in between (Figs. 6C, 10B).
annandalei (p. 17)
Claspette long and large, reaching to 0.75 of basimere, with 3 widened specialized setae on dorsal basal part and with numerous long setae ventral distal to it (Figs. 11C, 10D). *craggi* (p. 22)

PUPAE

1. Seta 2-IV, V laterad of 1-IV, V. 2
Seta 2-IV, V mesad of 1-IV, V. 5
- 2(1). Seta 2-IV, V laterad of 3-IV, V; seta 1-II usually with 3-6 branches, not dendritic (Fig. 14A). *desmotes* (p. 26)

- #### FOURTH STAGE LARVAE

- ## DESCRIPTIONS OF THE SUBGROUPS AND SPECIES

TAXONOMIC CHARACTERS: ADULT. *Head.* Palpi with white scales. *Thorax.* (1) Dorsocentral bristles absent; prescutellar bristles present; (2) scutum with a large median white patch, reaching from anterior margin to the

middle of the scutum; (3) with a patch of broad dark scales on each side of pre-scutellar space; (4) subspiracular, postspiracular areas with broad white scales; hypostigial, prealar and metameron areas without broad white scales; (5) scutellum with broad dark scales on midlobe and broad white scales on lateral lobe. *Legs*. (1) Knee-spot absent on forefemur, present on mid- and hindfemora; (2) midfemur without a median white spot on anterior surface; (3) all tibiae anteriorly dark without any white band; (4) hindtarsus with basal white bands on tarsomeres 1, 2; tarsomere 3 all dark or with small basal white; tarsomere 4 with basal white band or all dark; tarsomere 5 all dark. *Male Terminalia*. (1) Tergum IX concave at middle; (2) paraproct without ventral arms; (3) distimere simple, elongate, slightly longer than basimere, expanded subapically, with a spiniform process subapically. *Female Terminalia*. Tergum IX slightly broader than long, with well developed lateral lobes, each with 3 or 4 setae.

PUPA. *Abdomen*. (1) Seta 1-II usually well developed, with many branches, or sometimes with 4-8 branches, dendritic; (2) 2-IV, V laterad of 1-IV, V. Male genital lobe long and broad, slightly longer than wide.

LARVA. *Thorax*. (1) Seta 9-M usually double, rarely single, barbed; 10, 12-M single, long, stout and barbed; (2) basal spine of meso- and metapleural setae stout, straight and pointed at tip. *Segment VIII*. Comb scales in a row, arising from a sclerotized plate. *Siphon*. 1-S inserted about the level of, or before last tooth and dorsad of the teeth. *Anal Segment*. Marginal spicules stout and conspicuous, each spicule rather short and bluntly rounded at tip.

DISTRIBUTION. Species of this subgroup are found in northeastern India, Assam, Burma, Thailand, Vietnam, Taiwan, Java, Bali, Flores and Sulawesi (MAP III).

TAXONOMIC DISCUSSION. As currently interpreted, the *annandalei* subgroup consists of 2 species, *annandalei* and *craggi*. Both of these are found within the Southeast Asia area.

On present collection data, both members of the *annandalei* subgroup in Southeast Asia occur in the Oriental area of Belkin (1962) while *annandalei* is also known to occur in the Indomalayan area (Java, Bali, Flores and Sulawesi).

The *annandalei* subgroup combines some of the features of the *w-albus* and *mediopunctatus* subgroups; the adult shares the characteristics of some members of the *w-albus* subgroup in scutal markings and the characteristic of the *mediopunctatus* subgroup in pleural markings, the male terminalia share some characteristics of *w-albus* subgroup and the female terminalia are similar to both. The pupa is extremely similar to that of the *mediopunctatus* subgroup and the female pupae are frequently indistinguishable from those of *mediopunctatus* subgroup. The larva is essentially as in the *mediopunctatus* subgroup, except that the basal spine of the meso- and metapleural setae is reduced in extent and approaches the condition characteristic of the *w-albus* subgroup.

This subgroup appears to show the characters of the *w-albus* group better than the other 3 subgroups.

Yamada (1921) described *horishensis* as a species from a single female from Horisha, Formosa. Lien (1962: 626) considered it to be a subspecies of *annandalei* characterized by a posterior shifting of the abdominal bands and Mattingly (1965: 41) regarded it as a variety. *Aedes annandalei* is one of the most variable and most common species of the *w-albus* group in Southeast Asia. A study of large series of *annandalei* with associated larval and pupal skins from India, Thailand and Taiwan (Formosa) indicated that this character (the posterior shifting of the abdominal bands) is variable. Therefore, I con-

sider *horishensis* Yamada to be a synonym of *annandalei*.

BIONOMICS. Larvae and pupae are usually found in bamboo stumps and cut bamboos. Occasionally, they are found in bamboo internodes, split bamboo and in tree holes. The females bite man. The immature stages are associated with the *albopictus* subgroup of the *scutellaris* group and *mediopunctatus* subgroup of the *w-albus* group.

AEDES (STEGOMYIA) ANNANDALEI (THEOBALD)
(Figs. 6; 7; 8; 9A, B; 10A, B)

Stegomyia annandalei Theobald 1910a: 10 (♀).

Kingia annandalei Theobald 1910b: 139 (different combination).

Aedes horishensis Yamada 1921: 58 (♀).

Stegomyia annandalei Theobald, Barraud 1923a: 781 (♂*, ♀*) (synonymized *Kingia annandalei*); Barraud 1923b: 226; Borel 1928: 95 (♂*, ♀, L*).

Stegomyia annandalei var. *quadricincta* Barraud 1923b: 227 (♀).

Aedes (Stegomyia) annandalei (Theobald), Edwards 1922: 464; Edwards 1925: 40 (♀); Bonne-Wepster and Brug 1932: 98 (♂*, ♀, L*); Barraud 1934: 227 (♂*, ♀*, L*); Mattingly 1965: 39 (♂*, ♀*, P*, L*) (synonymized *horishensis*).

Aedes (Stegomyia) annandalei horishensis Yamada, Lien 1962: 626 (to subspecies status).

MALE. *Head.* Proboscis dark scaled, with some pale scales on ventral side, as long as forefemur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, as long as proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a broad median stripe or a median patch of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax* (Figs. 9A, B). Scutum with narrow dark scales and a large median oval white patch of narrow scales which reaches from anterior margin, narrows slightly posteriorly to about the middle of the scutum; a large patch of broad white scales on the lateral margin just before the level of the wing root and above the paratergite; prescutellar space with a few white narrow scales, sometimes all dark; a patch of broad dark scales on each side of prescutellar space and a few broad dark scales over the wing root and toward scutellum; acrostichal and dorso-central bristles absent; prescutellar bristles present; scutellum with broad dark scales on midlobe and broad white scales on lateral lobe; anterior pronotum with broad white scales; posterior pronotum with broad white scales and a few dark similar ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the subspiracular and post-spiracular areas, on the upper and lower portions of sternopleuron and on the mesepimeron; lower mesepimeron without bristles; metameron bare. *Wing.* With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; cell R_2 1.5 times as long as R_{2+3} . *Halter.* With dark scales. *Legs.* Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; forefemur anteriorly dark except for a baso-ventral white line; midfemur without median white spot on anterior surface;

hindfemur anteriorly with basal 0.67-0.75 white, a complete dark band present which separates the basal white stripe from the apical white scale patch; all tibiae anteriorly dark, without any white band; fore- and midtarsi with basal white band on tarsomere 1, sometimes midtarsus with a few white scales on basal area of tarsomere 2 as well; hindtarsus with basal white bands on tarsomeres 1, 2; tarsomere 3 dark; tarsomere 4 with basal 0.67 white band to all dark; tarsomere 5 dark; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Segment I with white scales on laterotergite; tergum II dark dorsally, with basal lateral white spots only; terga III-VI each with basal lateral white spots and a basal or subbasal white band which is connected to the lateral spots; tergum III with basal band rather narrow or sometimes incomplete at the middle; tergum VII with lateral white spots only; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia* (Figs. 6C, 10B). Basimere short, about 2.5 times as long as wide; its scales restricted to dorsolateral, lateral and ventral areas; with 4 (3-5) setae on basomesal area of the dorsal surface; claspette well developed, with 3 widened, leaf-like setae on tergal side and with 2 stout, spine-like setae on sternal side of expanded distal part, with several thinner (slender) setae scattered in between; distimere simple, elongate, slightly longer than basimere, expanded subapically, with setae and a spiniform process; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX concave at middle, with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects:

Head. Palpus 4-segmented, or sometimes 5-segmented, segment 5 minute, about 0.25 of proboscis, with white scales on less than apical half. *Legs*. Foretarsomere 2 sometimes with a few white scales on basal area; midtarsomere 2 with basal white band; hindtarsomere 4 with basal 0.83 white band; sometimes hindtarsomere 3 with a few white scales on basal area as well; fore- and midlegs with tarsal claws equal, all toothed. *Abdomen*. Tergum VII with lateral white spots and basal or subbasal white band which is not connected with the lateral spots; segment VIII largely retracted. *Terminalia* (Figs. 8, 10A). Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 6 (4-6) larger ones on apical third; tergum IX with well developed lateral lobes, each with 3 or 4 setae; postgenital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA (Figs. 6A, B). *Cephalothorax*. Trumpet about 3.5 times as long as wide at the middle; seta 1, 3-C usually single (1-2), longer than 2-C; 2-C usually double (1-2); 4-C usually single (1-2); 5-C usually double (2-3); 6-C single, shorter than 7-C; 7-C usually double (1-2); 10-C usually 2-branched (2-4), mesad and caudad of 11-C; 11-C single, stout. *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II with many branches, dendritic; 2-II laterad of 3-II; 2-IV, V laterad of 1-IV, V; 1-III usually with 4 branches (2-6); 1-IV usually double (2-5); 3-II, III single, shorter than segment III; 5-III usually single, rarely double; 5-IV-VI single, or sometimes 5-IV, V with 2 branches, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII longer and stouter than preceeding ones; 9-VII usually single (1-2), barbed; 9-VIII usually with 2 branches (1-4), barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; seta 1-P single.

LARVA (Fig. 7). *Head*. Antenna 0.5 length of head, without spicules; 1-A

inserted near or before middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; seta 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C single, long; 6-C double; 7-C usually with 2 branches (2-3); 8, 13-C single; 9-C usually double (2-3); 10-C usually double (1-2); 11, 12-C usually 3-branched (3-4); 14-C double, stout; 15-C usually with 2-3 branches; mentum with 9-11 teeth on each side. *Thorax*. Seta 1-P usually 3-branched (2-3); 2-P single; 3-P double; 4-P usually single (1-2); 5, 7-P usually double (1-2); 6-P single; 9-P single; 11-P single; 14-P usually double (2-3); 5, 7-M single; 6-M usually 3-branched (2-4); 8-M usually with 3 branches (2-3); 9-M usually double, rarely single, barbed; 10, 12-M single, long, stout and barbed; 11-M single, small; 7-T with 2-3 branches; 9, 10 and 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural setae stout, straight and pointed at tip. *Abdomen*. Seta 6-I, II 2-branched; 7-I single; 7-II usually with 4 branches (3-5); 6-III-V 2-branched, sometimes one more slender and shorter than the other; 6-VI single; 7-III with 3 or 4 branches, larger than 9-III; 4-I, II single; 1-VII usually with 3 branches (3-4), barbed; 2-VII 3-branched; comb of 4-7 scales in a row, arising from a sclerotized plate, each scale with fine denticles at the base of the apical spine; seta 2-VIII distant from 1-VIII; 1, 5-VIII 3-branched; 3-VIII with 4-5 branches; 2, 4-VIII single; saddle incomplete; marginal spicules stout and conspicuous, each spicule rather short and bluntly rounded at tip; 1-X 2-branched; 2-X usually with 2 branches (1-2), rarely 3-branched; 3-X single; ventral brush with 4 pairs of setae on grid, each seta usually single, sometimes 1 or 2 proximal ones double; no precratal tufts; anal papillae about 2 times as long as saddle, sausage-like. *Siphon*. About 2.2 times as long as wide, acus absent; 6-13 pecten teeth in a straight or irregular row, each tooth with fine basal denticles and distally transparent; 1-S usually with 2 branches (2-3), inserted about the level of or before last tooth and dorsad of the teeth.

TYPE-DATA. *Stegomyia annandalei* Theobald, type-female in Zoological Survey of India, Indian Museum, Calcutta, India; type-locality: Sukna, Darjeeling District (base of eastern Himalayas, 500 ft.), West Bengal, INDIA, VII-1908 (Annandale). *Stegomyia annandalei quadricinctus* Barraud, type-female in BMNH; type-locality: Nongpoh, Assam, INDIA, VII-1922 (Capt. P. J. Barraud). *Aedes horishensis* Yamada, type-female in the Department of Parasitology, The Institute of Medical Science, University of Tokyo, Tokyo, Japan; type-locality: Horisha, Formosa, 12-IV-1921 (S. Hirayama).

DISTRIBUTION. 1,535 specimens examined: 313♂, 257♀, 165♂ terminalia, 23♀ terminalia, 12 L, 399 individual rearings (368 l, 397 p).

BURMA. *Shan State*: Aung Ban (X-1965, de Meillon), 13♂, 11♀, 9♂ terminalia, 22 individual rearings (2 l, 21 p).

INDIA. *Assam*: Golaghat- (II-1911, Capt. P. J. Barraud), 1♂, 1♂ terminalia; (I-1912), 1♀; Nongpoh (VII-1922, P. J. Barraud), 1♂, 7♀, 1♂ terminalia; Chabua (VII-1943, D. E. Hardy), 1♀; Tezpur (V-1943, D. E. Hardy), 3♂, 3♂ terminalia. *Bengal*: Darjeeling Dist. - Sukna (III-1967, S. Ramalingam, E. D. Abraham & E. S. Abraham), 68♂, 36♀, 35♂ terminalia, 22 individual rearings (22 l, 22 p).

INDONESIA. *Java*: #3245 (V-1928, Brug), 1♂, 1♂ terminalia; Tjandjoer (V-1928, Brug), 2♂, 2♂ terminalia; Lembang (XII-1936, Brug), 1♂, 1♂ terminalia; Bandoeng (X-XI-1936, Brug), 2♂, 3♀; Maos (X-1936, Brug), 4♂, 1♀, 3♂ terminalia. *Sulawesi (Celebes)*: Kalawara, #12253 (II-1937, Brug), 1♀; Kabaena: #12782 (V-1937, Brug), 1♂, 1♂ terminalia; #12784 (V-1937, Brug), 1♀. *Lesser Sunda Islands*: *Bali*: #7752, #7761 (VI-1929), 2♀; #7753 (VI-1929), 1♂, 1♂ terminalia; *Flores*, Roeteng, #7773 (X-1931), 1♀.

TAIWAN. *Formosa*: Horisha (12-IV-1921, S. Hirayama), 1♀; (1950, C. Y. Chow), 2♂, 2♀, 2♂ terminalia; (VI-1953, J. C. Lien), 3♂, 2♀, 1♂ terminalia. *Nantou*: Yu Chich (VI-1959, T. S. Lo & W. C. Huang), 5♂, 3♂ terminalia. *Taichung*: Sun Moon Lake (VI-1948), 4♂, 4♂ terminalia. *Ping-tung*: (IV-1954, H. H. Chen), 2♀; (IV-1954, C. C. Lien), 1♀; (VIII-1958, C. J. Kuo & C. C. Kang), 5♂, 5♀, 5♂ terminalia; (IX-1968, L. C. Lu & J. H. Lin), 23♂, 22♀, 17♂ terminalia, 6♀ terminalia, 45 individual rearings (45 1, 45 p).

THAILAND. *Ayutthaya*: Ban Lain (X-1963), 1♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p). *Nakhon Ratchasima*: (V-VII-1963), 6♂, 6♂ terminalia; Khao Chang Chalut (IX-1971, Sanit & Sanit), 1♂, 1 individual rearing (1 p). *Kanchanaburi*: Huai Bong Ti (VI-1965, Kol & Peyton), 3♂, 3♂ terminalia, 3 individual rearings (2 l, 3 p). *Nan*: Ban Pha Man (VIII-1966, Kol), 1♂, 1♂ terminalia. *Chon Buri*: Khao Yai Li (IX-1968, Kol), 1♂, 1♂ terminalia, 1 individual rearing (1 p). *Lampang*: Ban Rai Na Dieo (V-1968, Kol), 1♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p); Huai Mae Phlung (V-1968, Kol & Harrison), 1♂, 1♂ terminalia, 1 individual rearing (1 p). *Nakhon Sawan*: Ban Hok Kak (X-1968, Kol & team), 1♂, 1♂ terminalia, 1 individual rearing (1 p); Ban Takhian Luan (XI-1968, Kol & team), 4♂, 4♂ terminalia, 4 individual rearings (1 l, 3 p); Ban-Ko (XI-1968, Kol & team), 4♂, 4♂ terminalia, 4 individual rearings (4 l, 4 p); Ko- Klang Dact (XI-1968, Kol & team), 1♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p). *Lop Buri*: Ban Thanon Sung (VI-1970, Prajim team), 29♂, 49♀, 27♂ terminalia, 3♀ terminalia, 78 individual rearings (78 l, 78 p). *Lamphun*: Doi Khum Tan (IX-1970, Kol & team), 1♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p). *Chiang Mai*: Huey Mae Lon (X-1963, Neely), 1♂, 1♂ terminalia, 1 individual rearing (1 p); Huai Phrao (IV-1970, Kol & team), 2♂, 2♂ terminalia, 2 individual rearings (2 p); Huts (VII-1970, Kol & team), 2♂, 2♂ terminalia, 2 individual rearings (2 l, 2 p); Ban Thung La Khon (VIII-1970, Kol & team), 10♀; (SEATO Medical Research Laboratory Insectory material, IV-V-1971), 113♂, 95♀, 18♂ terminalia, 14♀ terminalia, 12 L, 208 individual rearings (208 l, 208 p).

VIETNAM. *Saigon*: (XI-1955, H. H. Stage), 3♀.

REMARKS. I have not seen specimens of *annandalei* from Buru (Edwards 1925: 40), Ceram (Brug 1925: 668), Sumatra (Bonne-Wepster and Brug 1932: 101), New Guinea (Brug and Bonne-Wepster 1947: 185), and China (Chekiang Province, Hangchow, Li and Wu 1935: 96; Yunnan Province, Chow 1949: 130). Records from China may refer in part to *craggi*.

There are 2 female specimens, one (1932, L. C. Yeng) from Huchow, Chekiang Province, China and the other (VIII-1937, R. Crook) from Hain Kai Si Mt. Omei, 2,500 ft (ca. 760 m), Szechwan Province, China, in the BMNH in very poor condition and the specific identification is not possible. However, these are either *annandalei* or *craggi*.

TAXONOMIC DISCUSSION. *Aedes annandalei* is a member of the *annandalei* subgroup. The adult differs from all the other members of the *desmotes*, *mediopunctatus* and *w-albus* subgroups by having the scutellum with broad dark scales on the midlobe and broad white scales on the lateral lobe. It is very similar to *craggi* in having the scutum with a large median white patch of narrow scales on the anterior half of the scutum, a large patch of broad white scales on the lateral margin just before the level of the wing root and above the paratergite; subspiracular and postspiracular areas with broad white scales, hypostigial, prealar and metameron areas without broad white scales, and midfemur without a median white spot on the anterior surface. It can be recognized, however, by the scutum having a large median oval white patch of narrow scales which reaches from the anterior margin, narrows slightly

posteriorly to about the middle of the scutum; in *craggi* the scutum has a large median triangular white patch of narrow scales which reaches from the anterior margin to about the anterior half of the lateral prescutal area and narrows posteriorly to the middle of the scutum.

The male terminalia of *annandalei* are very similar to those of *craggi*, having tergum IX concave at the middle, paraproct without ventral arms, and distimere simple, elongate, slightly longer than basimere, expanded subapically, with setae and a spiniform process. They can easily be distinguished from those of *craggi* by having the claspette well developed, with 3 widened, leaf-like setae on tergal side and with 2 stout spine-like setae on sternal side of expanded distal part, with several thinner (slender) setae scattered in between.

The larva of *annandalei* is very similar to those of *craggi*, *desmotes*, *malikuli*, *perplexus* and *mediopunctatus* in having the basal spine of the meso- and metapleural setae well developed and large and comb scales in a row, arising from a sclerotized plate. It is closer to those of *craggi*, *malikuli*, *perplexus* and *mediopunctatus* in having marginal spicules well developed and conspicuous. The larva of *annandalei* is indistinguishable from that of *craggi*. It differs from *malikuli*, *perplexus* and *mediopunctatus* in having seta 1-S inserted about the level of, or before last tooth and dorsad of the teeth; marginal spicules stout, each spicule rather short and bluntly rounded at tip.

The pupa of *annandalei* is extremely similar to those of *craggi*, *malikuli*, *perplexus* and *mediopunctatus*, having seta 1-II usually well developed, dendritic, with many branches; 2-IV, V laterad of 1-IV, V. It is often indistinguishable from those of *craggi*, *malikuli*, *perplexus* and *mediopunctatus* except in the male. The male pupa of *annandalei* differs from *malikuli*, *perplexus* and *mediopunctatus* in having the male genital lobe long and broad, slightly longer than wide, and from that of *craggi* in having the male genital lobe without a triangular-shape fold on ventral side.

The immature stages are often found in association with those of *albopictus* (Skuse), *craggi*, and *perplexus* in the field. The larva of *annandalei* can easily be distinguished from that of *albopictus* by having comb scales in a row, arising from a sclerotized plate, whereas *albopictus* has comb scales in a row, without a sclerotized plate. The pupa of *annandalei* has seta 2-IV, V laterad of 1-IV, V and 9-VII usually single (1-2), barbed. It can also be distinguished from *albopictus* which has seta 2-IV, V, mesad of 1-IV, V and 9-VII single, simple. The immature stages of *annandalei* greatly resemble those of *craggi* and *perplexus*. The discussion under *annandalei* deals with this matter.

Aedes annandalei is apparently a common species in Southeast Asia. It is presently known from northeastern India, Burma, Thailand, Vietnam, Taiwan, Java, Bali, Flores and Sulawesi.

BIONOMICS. The immature stages of *annandalei* have been collected mainly in bamboo stumps in Burma, India, Taiwan and Thailand and in cut bamboos in Java. They have also been found in a bamboo internode and in bamboo cups in Thailand. The specimens from India were found in plain and hill areas, about 500-600 ft (ca. 150-180 m), in bamboo groves and in secondary rain forests. Thailand specimens were found in plain, hill, valley and mountain areas, about 20-960 m, in bamboo groves, in rain forests and deciduous forests and in orchard plantations in villages. The females have been taken biting man in secondary deciduous forest in Chiang Mai Province, Thailand. The immature stages were associated with *albopictus*, *craggi* and *perplexus*.

Aedes (Stegomyia) craggi (Barraud)

(Figs. 9C, D; 10C, D; 11; 12; 13)

Stegomyia craggi Barraud 1923b: 227 (♂*).*Aedes (Stegomyia) purii* Barraud 1931: 226 (♂*).*Aedes (Stegomyia) craggi* (Barraud), Barraud 1934: 229 (♂*) (synonymized *purii*).

MALE. Head. Proboscis dark scaled, with some pale scales on ventral side, as long as forefemur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those of segments 4, 5 incomplete dorsally; segment 5 with white basal band on ventral side very small or sometimes without white basal band; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, as long as proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a broad median stripe or a median patch of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax* (Figs. 9C, D). Scutum with narrow dark scales and a large median triangular white patch of narrow scales which reaches from anterior margin and about anterior half of the lateral prescutal area, narrows posteriorly and to the middle of the scutum; a large patch of broad white scales on the lateral margin just before the level of the wing root and above the paratergite; prescutellar space with some white narrow scales, sometimes with a few broad ones as well; a patch of broad dark scales, or sometimes with a few broad white scales as well, on each side of prescutellar space; a few broad dark scales over the wing root and toward scutellum; acrostichal and dorsocentral bristles absent; prescutellar bristles present; scutellum with broad dark scales on mid-lobe and broad white scales on lateral lobe; anterior pronotum with broad white scales; posterior pronotum with broad white scales and a few dark similar ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the subspiracular and postspiracular areas, on the upper and lower portions of sternopleuron and on the mesepimeron; lower mesepimeron without bristles; metameron bare. *Wing.* With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; cell R_2 1.5 times as long as R_{2+3} . *Halter.* With dark scales. *Legs.* Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; forefemur anteriorly dark except for a basoventral white line; midfemur without median white spot on anterior surface; hindfemur anteriorly with basal 0.67 white, a complete dark band present which separates the basal white stripe from the apical white scale patch, sometimes the dark band not complete on the lower portion of anterior surface; all tibiae anteriorly dark, without any white band; fore- and midtarsi with basal white band on tarsomere 1; hindtarsus with basal white bands on tarsomeres 1, 2; tarsomeres 3-5 all dark, sometimes tarsomere 4 with a few white scales on basal area; fore- and mid-legs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen.* Segment I with white scales on laterotergite; tergum II dark dorsally, with basal lateral white spots only; terga III-VI each with basal lateral white spots and a basal white band which is connected to the lateral spots; sometimes tergum III with basal band rather narrow or incomplete at the middle; tergum VII with lateral white spots only or sometimes tergum VII

with basal white band as well; sternum II largely covered with white scales; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia* (Figs. 11C, 10D). Basimere short about 2.3 times as long as wide; its scales restricted to lateral and ventral areas; claspette long and large, reaching to 0.75 of basimere, with 3 widened specialized setae on dorsal basal part and with numerous long setae ventral distal to it; distimere simple, elongate, slightly longer than basimere, expanded subapically, with setae and a spiniform process; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX concave at middle, with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects:

Head. Palpus 4-segmented, about 0.25 of proboscis, with white scales on less than apical half. *Legs.* Midtarsomere 2 with basal white band; hindtarsomere 4 with basal 0.83 white band; sometimes hindtarsomere 3 with a few pale yellowish scales on basal area; fore- and midlegs with tarsal claws equal, all toothed. *Abdomen.* Tergum VII with lateral white spots and basal white band which is not connected with the lateral spots; segment VIII largely retracted. *Terminalia* (Figs. 10C, 13). Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 3 or 4 larger ones on apical third; tergum IX with well developed lateral lobes, each with 3 or 4 setae; postgenital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA (Figs. 11A, B). *Cephalothorax.* Trumpet 2.5-3.0 times as long as wide at the middle; seta 1, 3-C usually double (1-2), longer than 2-C; 2-C usually double (1-2); 4, 5-C usually double (1-2); 6-C single, shorter than 7-C; 7-C usually double (1-2); 10-C usually 2-branched (2-4), mesad and caudad of 11-C; 11-C single, stout. *Abdomen.* Seta 1-I well developed dendritic, with more than 10 branches; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II with many branches, or sometimes with 4-8 branches, dendritic; 2-II laterad of 3-II; 2-IV, V laterad of 1-IV, V; 1-III usually with 2-5 branches; 1-IV usually with 3 branches (2-6); 3-II, III single, shorter than segment III; 5-III usually single, rarely double; 5-IV-VI single or sometimes 2-branched, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII much longer and stouter than preceding ones; 9-VII single, stout and barbed; 9-VIII usually with 3 branches (1-3), barbed, reaching beyond fringe of paddle. *Paddle.* Margins with fringe; seta 1-P single. Male genital lobe with a triangular-shape fold on ventral side.

LARVA (Fig. 12). *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; seta 4-C well developed, branched, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C single, long; 6-C double; 7-C usually with 2 branches (2-3); 8-C single; 9-C usually with 2-3 branches; 10-C usually double; 11-C usually with 3-4 branches; 12-C usually 3-branched (2-4); 13-C single or double; 14-C double, stout; 15-C usually double (2-4); mentum with 10-12 teeth on each side. *Thorax.* Seta 1-P usually 3-branched; 2-P single; 3-P double; 4-P single; 5, 7-P usually double; 6-P single; 9-P single; 11-P single; 14-P double; 5, 7-M single; 6-M usually 3-branched; 8-M usually 3-branched (3-4); 9-M usually double, rarely single, barbed; 10, 12-M single, long, stout and barbed; 11-M single, small; 7-T usually 3-branched (3-5); 9, 10 and 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural setae stout, straight and pointed at tip. *Abdomen.* Seta 6-I, II 2-branched; 7-I usually single (1-2); 7-II usually with 4 branches

(4-5); 6-III-VI 2-branched, usually one more slender than the other; sometimes 6-VI single; 7-III with 4 branches, large, much larger than 9-III; 4-I II single; 1-VII usually 4-branched; 2-VII with 3-4 branches; comb of 4-6 scales in a row, arising from a sclerotized plate, each scale with fine denticles at the base of the apical spine; seta 2-VIII distant from 1-VIII; 1, 5-VIII 3-branched; 3-VIII 4-branched; 2, 4-VIII single; saddle incomplete; marginal spicules stout and conspicuous, each spicule rather short and bluntly rounded at tip; 1-X 2-branched; 2-X usually with 2 branches; 3-X single; ventral brush with 4 pairs of setae on grid, each seta single; no precratal tufts; anal papillae about 2 times as long as saddle, sausage-like. *Siphon*. About 2.5 times as long as wide, acus absent; 7-15 pecten teeth, in a straight or irregular row, each tooth with or without fine basal denticles and transparent distally; 1-S with 2-3 branches, inserted about the level of or before last tooth and dorsad of the teeth.

TYPE-DATA. *Stegomyia craggi* Barraud, type-male in BMNH, type-locality: Haflong, Assam, INDIA, VIII-1922 (Capt. P. J. Barraud). *Aedes* (*Stegomyia*) *purii* Barraud, 1 cotype male (2144) in BMNH; 1 cotype male in Malaria Institute of India, Delhi, India; type-locality: Marianbarrie Tea Estate, near Sukna, North Bengal, INDIA, VIII-1928 (Puri).

DISTRIBUTION. 398 specimens examined: 109♂, 18♀, 102♂ terminalia, 7♀ terminalia, 110 individual rearings (59 l, 103 p).

INDIA. *Assam*: Haflong (VIII-1922, Capt. P. J. Barraud), 1♂, 1♂ terminalia. *Bengal*: Darjeeling Dist.-Marianbarrie Tea Estate, near Sukna (VIII-1928, Puri), 1♂, 1♂ terminalia; Mungpoo (III-1967, S. Ramalingam, E. D. Abraham & E. S. Abraham), 7♂, 7♂ terminalia, 4 individual rearings (1 l, 4 p); Pashok (III-1967, S. Ramalingam, E. D. Abraham & E. S. Abraham), 2♂, 2♂ terminalia.

THAILAND. *Nan*: Ban Pha Hang (VIII-1966, Peyton), 1♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p); (VIII-1966, Somboon), 1♂, 1♂ terminalia; (VIII-1966, Chaliou), 1♂, 1♂ terminalia. *Lampang*: Ban Rai Na Dieo (V-1968, Sumeth & Chaliou), 3♂, 3♂ terminalia, 3 individual rearings (2 p); (V-1968, Harrison & team), 8♂, 8♂ terminalia, 8 individual rearings (7 p); (V-1968, Kol & Samboon), 2♂, 2♂ terminalia, 2 individual rearings (2 p); Doi Pha Huat (V-1968, Kol), 2♂, 2♂ terminalia, 2 individual rearings (1 l, 2 p); San Chao Pho Pratu Pha (V-1968, Kol), 1♂, 1♂ terminalia. *Chiang Mai*: Ban Mae Lan Mae (X-1963, Neely), 1♂, 1♂ terminalia; Luam (V-1964), 2♂, 2♂ terminalia; Ban Pong Goom (IV-1964), 1♂, 1♂ terminalia; Huai Phrao (IV-VII-1970, Kol & team), 31♂, 31♂ terminalia, 31 individual rearings (12 l, 30 p); Bam Choeng Doi Suthep (VII-1970, Chaliou & Anun), 1♂, 1♂ terminalia, 1 individual rearing (1 p); Ban Sop O Nok (VII-1970, Kol & Anun), 8♂, 8♂ terminalia, 8 individual rearings (6 l, 8 p); Huts (VII-1970, Kol & team), 12♂, 12♂ terminalia, 12 individual rearings (7 l, 10 p); Ban Tham Klaep (VII-IX-1970, Kol & team), 4♂, 4♂ terminalia, 4 individual rearings (3 l, 4 p); Ban Thung La Khon (VIII-1970, Kol & team), 1♂, 1♂ terminalia; Ban Huai Tat (IX-1970, Kol & team), 2♂, 2♂ terminalia, 2 individual rearings (1 p); Doi Khum Tan (IX-1970, Kol & team), 3♂, 3♂ terminalia, 3 individual rearings (2 p); Amphoe Chiang Dao (IX-1970, Kol & team), 1♂, 1♂ terminalia, 1 individual rearing (1 p); Doi Pha Daeng (VII-1972, Kol & team), 2♀, 2 progeny rearings: No. (1) -7♂, 5♀, 2♂ terminalia, 4♀ terminalia, 12 individual rearings (12 l, 12 p); No. (2) -5♂, 11♀, 3♂ terminalia, 3♀ terminalia, 16 individual rearings (16 l, 16 p).

TAXONOMIC DISCUSSION. *Aedes craggi* is a member of the *annandalei* subgroup. The adult has the scutellum with broad dark scales on the midlobe and broad white scales on the lateral lobe, and can thus easily be distinguished

from all other species except *annandalei*. It is very similar to *annandalei* but can be separated from it by the diagnostic characters mentioned under the discussion of that species.

The male terminalia of *craggi* are also very similar to those of *annandalei* but can easily be distinguished from it by having the claspette long and large, reaching to 0.75 of basimere, with 3 widened specialized setae on dorsal basal part and with numerous long setae ventral distal to it.

The larva of *craggi* cannot be separated from that of *annandalei*. The pupa of *craggi* is extremely similar to and often indistinguishable from those of *annandalei*, *malikuli*, *perplexus* and *mediopunctatus* except for the male pupa. The male pupa of *craggi* has the male genital lobe with a triangular-shape fold on ventral side, thus differing from all other species that have been described in this group.

The immature stages are often found in association with those of *albopictus*, *pseudalbopictus* (Borel), *annandalei*, *malikuli* and *perplexus* in the field. The larva of *craggi* differs from those of *albopictus* and *pseudalbopictus* in having the comb scales in a row, arising from a sclerotized plate, whereas *albopictus* and *pseudalbopictus* have the comb scales in a row, without a sclerotized plate. The pupa of *craggi* with setae 2-IV, V laterad of 1-IV, V and 9-VII usually single (1-2), barbed, can also be distinguished from those of *albopictus* and *pseudalbopictus* which have setae 2-IV, V mesad of 1-IV, V and 9-VII single, simple. The larva of *craggi* is indistinguishable from that of *annandalei* but can easily be distinguished from those of *malikuli* and *perplexus* by having seta 1-S inserted about the level of, or before last tooth and dorsad of the teeth; marginal spicules stout, each spicule rather short and bluntly rounded at tip; *malikuli* and *perplexus* have seta 1-S inserted beyond last tooth and in line with the teeth; marginal spicules long, each spicule usually pointed at tip. The pupa of *craggi* greatly resembles those of *annandalei*, *malikuli* and *perplexus*. (See discussion under *craggi*).

Aedes craggi is apparently confined to the Oriental region. It is known from northeastern India and the northern part of Thailand. In Southeast Asia it is reported here for the first time from Thailand (Chiang Mai, Lampang, Nan).

BIONOMICS. The immature stages of *craggi* have been collected mainly in bamboo stumps in India and Thailand. They have also been found in a stump hole, a split bamboo and in a tree hole in Thailand. The specimens from India were found in mountainous areas, about 550-920 m, in secondary rain forests and in bamboo groves and those from Thailand were found in mountainous areas, 240-980 m, in deciduous forests. Females have been taken biting man in a deciduous forest in the mountains of Chiang Mai Province and also in Kanchanaburi Province, Thailand. The immature stages were associated with *albopictus*, *pseudalbopictus*, *annandalei*, *malikuli* and *perplexus*.

desmotus subgroup

TAXONOMIC CHARACTERS: ADULT. *Head.* Palpi with white scales.

Thorax. (1) Dorsocentral bristles absent; prescutellar bristles present; (2) scutum with a white longitudinal stripe on either side of midline, extending from anterior margin, narrowing posteriorly and reaching to the middle of the scutum; (3) without a patch of broad dark scales on each side of prescutellar space; (4) hypostigial, subspiracular, postspiracular, prealar and metamerone areas with broad white scales; (5) scutellum with broad white scales on all

lobes. *Legs.* (1) Knee-spot absent on forefemur, present on mid- and hind-femora; (2) midfemur with 2 white spots on anterior surface; (3) all tibiae anteriorly dark, each with a white band; (4) hindtarsus with basal white bands on tarsomeres 1-3; tarsomeres 4, 5 all white or with apex dark. *Male Terminalia.* (1) Tergum IX nearly flat at middle; (2) paraproct with ventral arms; (3) distimere simple, elongate, 0.7 as long as basimere, with a short spiniform process near apex. *Female Terminalia.* Tergum IX much broader than long, at least 2 times as wide as long, with well developed, widely separated lateral lobes, each with 4-6 setae.

PUPA. Abdomen. (1) Seta 1-II usually with 4 branches (3-6); (2) 2-IV, V distinctly laterad of 1-IV, V. Male genital lobe long and narrow, much longer than wide.

LARVA. Thorax. (1) Seta 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; (2) basal spine of meso- and metapleural setae long, straight and blunt at tip. *Segment VIII.* Comb scales in a row, arising from a sclerotized plate. *Siphon.* 1-S inserted beyond last tooth and in line with the teeth. *Anal Segment.* Marginal spicules very small and inconspicuous.

DISTRIBUTION. The *desmotes* subgroup, consisting of a single species, occurs from eastern India in the west, to the Philippines in the east, through Assam, Thailand to Taiwan in the northeastern corner and through Peninsular Malaysia, Kalimantan to Sulawesi in the southeastern corner (MAP IV).

TAXONOMIC DISCUSSION. As currently interpreted, the *desmotes* subgroup consists of one species, *desmotes*. This species is found within the Southeast Asia area.

Based on the present collection data, the monotypic *desmotes* subgroup in Southeast Asia occur in both the Oriental and Indomalayan areas.

The *desmotes* subgroup is well marked in all stages. The ornamentation of the adult shares many characteristics of the *w-albus* subgroup. The pupa shares the characteristic of the *annandalei* and *mediopunctatus* subgroups in having seta 2-IV, V laterad of 1-IV, V. The larva shares most of the characteristics of the *mediopunctatus* subgroup, except that the marginal spicules of the anal segment are very small and inconspicuous as in the *w-albus* subgroup.

This subgroup is well differentiated from the other subgroups in all stages, including the female terminalia.

BIONOMICS. Larvae and pupae are usually found in bamboo internodes, split bamboos and bamboo stumps. The females bite man. The immature stages are associated with those of the *mediopunctatus* subgroup of the *w-albus* group.

AEDES (STEGOMYIA) DESMOTES (GILES)
(Figs. 14; 15; 16; 17A, B; 18A, C; 21A)

Stegomyia desmotes Giles 1904: 367 (♀).

Anisocheleomyia (?) *albitarsis* Ludlow 1905b: 131 (♀).

Stegomyia gracilis Leicester 1908a: 81 (♂, ♀).

Stegomyia albipes Theobald 1910a: 11 (♀).

Stegomyia montana Koidzumi 1918: 141 (♂); Koidzumi 1920: 64.

Stegomyia desmotes Giles, Edwards 1913: 225 (synonymized *gracilis* and *albipes*); Barraud 1923b: 224 (♂*); Borel 1928: 80 (♀, L*).

Aedes (Stegomyia) desmotes (Giles), Edwards 1922: 464 (synonymized

albitarsis); Dyar and Shannon 1925: 74; Bonne-Wepster and Brug 1932: 102 (σ^* , φ^* , L*); Barraud 1934: 225 (σ^* , φ , L); Knight and Hull 1952: 170 (σ^* , φ , L*); Lien 1962: 626; Mattingly 1965: 43 (σ^* , φ^* , P*, L*) (designated *gracilis* cotype σ , as lectotype).

MALE. *Head.* Proboscis dark scaled, sometimes with a few pale scales on ventral side, as long as forefemur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax.* (Figs. 17A, B). Scutum with narrow dark scales and a white stripe of narrow scales on either side of midline, the white stripe narrows posteriorly from the anterior margin and reaches to the middle of the scutum; some white narrow scales on the anterior prescutal area and on the lateral prescutal area; an antealar white patch present, with narrow white scales mainly and with some broad white ones on the lateral margin just before the level of the wing root; a posterior dorsocentral white line which reaches to the middle of the scutum and fusing with the antealar patch; prescutellar space surrounded by white narrow scales which continue forwards for a short distance; acrostichal and dorsocentral bristles absent; prescutellar bristles present; scutellum with broad white scales on all lobes; anterior pronotum with broad white scales; posterior pronotum with broad white scales and some narrow white ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the hypostigial, subspiracular, postspiracular and prealar areas, on the upper and lower portions of sternopleuron and on the mesepimeron; upper sternopleural scale patch does not connect with the prealar scale patch; lower mesepimeron without bristles; metameron with broad white scales. *Wing.* With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; cell R_2 1.5 times as long as R_{2+3} . *Halter.* With dark scales. *Legs* (Fig. 21A). Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; forefemur anteriorly dark except for a basoventral white line; midfemur with 2 white spots on anterior surface, one before the middle and one beyond the middle; hindfemur anteriorly with basal 0.67 white, an oblique dark band present and separates the basal white stripe from the apical white scale patch; all tibiae anteriorly dark, each with a white band at about basal third; fore- and midtarsi with basal white bands on tarsomeres 1, 2; hindtarsus with basal white bands on tarsomeres 1-3; the ratio of length of white band to the total length of tarsomere is 0.33, 0.40 and 0.40, tarsomere 4, 5 all white or sometimes tarsomere 4 with apex dark, or sometimes tarsomere 5 also dark at tip; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen.* Segment I with white scales on laterotergite; terga II-VI with large basal lateral white spots; terga III-VI each with a basal white band which is not connected with the lateral spots; tergum VII with small lateral white spots only or sometimes tergum VII with basal white band as well; sterna III-VI with basal white bands; sternum VII dark; sternum VIII largely covered with white scales. *Terminalia* (Fig. 14C). Basimere about 3 times as long as wide; its scales restricted to dorso-lateral, lateral and ventral areas; claspette with 2 setose lobes, without any

widened specialized setae; distimere simple, elongate, 0.7 as long as basimere; with numerous short setae and a short spiniform process and subapical inner side and with several long apical setae; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct with ventral arms; cercal setae absent; tergum IX nearly flat at middle, with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects: *Head* (Fig. 18A). Palpus 5-segmented, segment 5 minute, about 0.25 of proboscis, with white scales on less than apical half. *Legs.* Fore- and midlegs with tarsal claws equal, all toothed. *Abdomen.* Terga VII-VIII each with lateral white spots and basal white band which is not connected with the lateral spots; segment VIII not retracted. *Terminalia* (Figs. 16, 18C). Sternum VIII with a deep U-shaped notch at middle and with conspicuous lateral lobes; insula longer than broad, with minute setae and with 8 (6-10) larger ones on apical third; tergum IX short and broad, with well developed, widely separated lateral lobes, each with 4-6 setae; postgenital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA (Figs. 14A, B). *Cephalothorax.* Trumpet short, about 3 times as long as wide at the middle; seta 1, 3-C usually single (1-2), longer than 2-C; 2-C usually single (1-2); 4, 5-C single; 6-C single, slightly shorter than 7-C; 7-C single; 10-C single or 2-branched, mesad and caudad of 11-C; 11-C single, stout. *Abdomen.* Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II usually with 4 branches (3-6); 2-II, III laterad of 3-II, III; 2-IV, V laterad of 1-IV, V; 1-III usually with 3 branches (2-4); 1-IV usually double (2-4); 3-II, III single, shorter than segment III; 5-IV-VI single or double, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII much longer and stouter than preceeding ones; 9-VII usually single (1-2) and barbed; 9-VIII usually with 2 branches (1-4) and barbed, reaching beyond fringe of paddle. *Paddle.* Margins with fringe; seta 1-P single.

LARVA (Fig. 15). *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; seta 4-C well developed, with 7-10 branches, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C usually single (1-2), long; 6-C with 2-5 branches; 7-C usually single (1-2); 8-C single; 9-C with 2 branches; 10-C usually single (1-2); 11-C with 3-4 branches; 12-C with 6-8 branches; 13-C with 4-6 branches; 14-C with 2-3 branches; 15-C usually single (1-2); mentum with 11-13 teeth on each side. *Thorax.* Seta 1-P usually double; 2-P single; 3-P double; 4-P single; 5, 7-P usually single; 6-P single, thinner than 5-P; 9-P single; 11-P single; 14-P 2-branched; 5-M single; 7-M single, much smaller than 5-M; 6-M usually single; 8-M with 2 branches; 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; 11-M single, small; 7-T with 2 branches; 9, 10- and 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural setae long, straight and blunt at tip. *Abdomen.* Seta 6-I-VI 2-branched; 7-I single; 7-II usually single (1-2); 7-III with 3-4 branches, small, much smaller than 9-III; 4-I, II with 2-3 branches; 1-VII usually with 3 branches (2-3); 2-VII single or double; comb of 3-5 scales in a row, arising from a sclerotized plate, each scale with fine denticles at the base of the apical spine; sometimes comb scale with apical spine split at tip; 2-VIII distant from 1-VIII; 1, 5-VIII usually with 3 branches (1-3); 3-VIII usually with 4 branches (2-4); 2, 4-VIII single; saddle incomplete; marginal spicules very small and inconspicuous; 1-X usually

3-branched (1-4), short; 2-X usually 2-branched, rarely single; 3-X single; ventral brush with 4 pairs of setae on grid, each seta single; 4d-X smaller than others; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like. *Siphon*. About 2 times as long as wide, acus absent; pecten teeth usually 3-8 (1-9), evenly spaced, each tooth rather small, with 1-4 basal denticles; 1-S with 2-4 branches, inserted beyond last tooth and in line with the teeth.

TYPE-DATA. *Stegomyia desmotes* Giles, type-female in BMNH; type-locality: Camp Stotsenberg, Luzon, PHILIPPINES, 1904 (Whitmore). *Anisocheleomyia (?) albitarsis* Ludlow, type-female in USNM; type-locality: Camp Stotsenberg, Luzon, PHILIPPINES, Sept. ? (Whitmore). *Stegomyia gracilis* Leicester, 1 cotype male designated lectotype by P. F. Mattingly, 23-I-1964, with terminalia on slide, in BMNH; type-locality: Ulu Klang jungle, 8 miles from Kuala Lumpur, Selangor, MALAYSIA, 22-IX-1903 (G. F. Leicester). *Stegomyia albipes* Theobald, type-female in Indian Museum; type-locality: Maddathurai, W. Ghats, Travancore, INDIA, 17-XI-1908 (Annandale). *Stegomyia montana* Koidzumi, type-male, location unknown; type-locality: Chikutoki, Kagi District, TAIWAN, VII-1917 (M. Koidzumi).

DISTRIBUTION. 499 specimens examined: 70♂, 195♀, 34♂ terminalia, 17♀ terminalia, 12 L, 97 individual rearings (75 l, 96 p).

INDIA. Bihar: Pusa (22-VII-1900). 1♀; Kanara: Kodra (IX-1921, P. J. Barraud), 2♀; Bengal: Sukna (VIII-1928), 1♂, 1♂ terminalia; Madras: Nilgiris (X-1915, P. J. Barraud), 1♂, 1♂ terminalia; Assam: Golaghat (IV-1925, P. J. Barraud), 1♀.

INDONESIA. Kalimantan (Dutch Borneo): Mahakham, Long Pahangai (IV-V-1929), 1♀; Sulawesi: Boeton, Baoe-Baoe (XII-1933), 3♀.

MALAYSIA. Peninsular Malaysia: Selangor - Kuala Lumpur (22-IX-1903, G. F. Leicester), 1♂, 1♂ terminalia; (A. T. Stanton), 2♀; Ulu Gombak (I-1956, W. W. M.), 7♂, 7♀, 2♂ terminalia, 4 individual rearings (4 l, 4 p); Ulu Langat F. R. (X-1966, Ramalingam team), 1♂, 1♀, 1♂ terminalia; (VI-1966, Ramalingam team), 1♀; (VIII-1968, Ramalingam team), 1♀; Ulu Klang (III-1967, Ramalingam team), 3♀; Pahang - Benteng (VII-1954), 1♀; Bentong Rd. (III-1967, Ramalingam team), 1♀; Merapoh (IV-1967, Ramalingam team), 1♂, 1♂ terminalia; Kedah - Sintok F. R. (XI-XII-1967, Ramalingam team), 5♂, 14♀, 4♂ terminalia, 2♀ terminalia, 4 L, 1 individual rearing (1 l, 1 p), slide only no adult.

PHILIPPINES. Luzon: Pampanga Prov., Camp Stotsenberg (1904, & IX-?, Whitmore), 2♀; Subic Bay (VII-1964, R. T. Holway), 3♀; (VI-VIII-1945, Rozeboom, Knight & Laffoon), 3 individual rearings (3 l, 3 p), 3 slides only no adult; Olongapo (VII-1945, Rozeboom, Knight & Laffoon), 5♂, 4♂ terminalia; Mountain Prov., Lagawe (VI-1969, Huang & Peyton), 4♂, 16♀, 2♂ terminalia, 4♀ terminalia, 20 individual rearings (13 l, 20 p); Laguna - Los Banos (IX-1914), 1♂, 1♂ terminalia; Pangil (VI-VII-1969, Huang & Peyton), 2♂, 3♀, 2♀ terminalia, 5 individual rearings (5 l, 5 p); Negros: Occ. - Mailum (V-1906, C. S. Banks), 1♀; Palawan: Puerto Princesa (V-1945, Rozeboom, Knight & Laffoon), 1♀; Philippine Islands (III-VI-1963), 5♂, 1♀, 4♂ terminalia; (no date), 3♂, 4♀.

TAIWAN. Taichung: Sun Moon Lake (VI-1948), 2♂, 3♀, 1♂ terminalia.

THAILAND. Phrae: Rong Kwang (XI-1952, D. C. & E. B. Thurman), 1♀; Lamphun: Huey Bpong Lee Dist. (XI-1952, D. C. & E. B. Thurman), 3♀; Udon Thani: (X-XI-1962, SEATO), 3♀; Loei: Phukadung (1962, SEATO), 1♀; Kanchanaburi: Huai Mae Nam Noi (1965, SEATO), 5♂, 1♀, 5♂ terminalia, 4 L, 4 individual rearings (1 l, 4 p); Ban Sai Yok (1965, SEATO), 1♂, 3♀, 1 L, 4

individual rearings (1 l, 4 p); Huai Bong Ti (1965, SEATO), 3 L; *Nakhon Si Thammarat*: Banna Nabon (1962, SEATO), 13♀; Ban Sai Koe (1966, SEATO), 2♀, 2 individual rearings (2 p); *Nan*: Doisamsop (1966, SEATO), 1♀; Ban Pha Man (1966, SEATO), 4♀, 4 individual rearings (2 l, 4 p); *Lampang*: (1968, SEATO), 18♀; *Nakhon Sawan*: Khao Luang Nur (1968, SEATO), 22♀; *Prachin Buri*: Khao Chang Chalut (VIII-1971, SEATO), 14♀; *Chiang Mai*: Measanan (1962, SEATO), 10♀; Kong Loi (1962, SEATO), 1♀; Huai Pao (1970, SEATO), 4 progeny rearings: No. 04459 (1)- 9♂, 7♀, 1♀ terminalia, 16 individual rearings (12 l, 16 p); No. 04459 (2)- 3♂, 3♀, 1♂ terminalia, 2♀ terminalia, 6 individual rearings (5 l, 5 p); No. 04459 (4)- 4♂, 5♀, 2♀ terminalia, 9 individual rearings (9 l, 9 p); No. 04459 (5)- 9♂, 10♀, 5♂ terminalia, 4♀ terminalia, 19 individual rearings (19 l, 19 p).

REMARKS. I have not seen specimens of *desmotes* from Soemba (Brug, 1926: 475).

TAXONOMIC DISCUSSION. *Aedes desmotes*, a member of the *desmotes* subgroup, is a very clearly marked species in all stages. The adult differs from that of all other species by the presence of 2 white spots on the anterior surface of the midfemur and all tibiae anteriorly dark, each with a white band. It is very similar to that of *g. gardnerii*, a member of the *w-albus* subgroup, having the scutum with a white longitudinal stripe on either side of the midline, extending from the anterior margin to the middle of the scutum, an antalar white patch present, a posterior dorsocentral white line present and scutellum with broad white scales on all lobes. It can easily be recognized, however, by the absence from the scutum of the patch of broad dark scales on each side of prescutellar space which is present in *g. gardnerii*. It also closely resembles those of *g. gardnerii*, *gardnerii imitator* and *w-albus*, members of the *w-albus* subgroup, in the pleural markings but can easily be distinguished from these as the upper sternopleural scale patch is not connected with the prealar scale patch; in *g. gardnerii*, *gardnerii imitator* and *w-albus* these patches are connected.

The male terminalia of *desmotes* have tergum IX nearly flat at the middle and the paraproct with ventral arms, thus differing from those of all other species that have been described in this group. The female terminalia of this species have tergum IX much broader than long, at least 2 times as wide as long, with well developed, widely separated lateral lobes, each with 4-6 setae, and can thus easily be distinguished from those of all other species.

The larva of *desmotes* is very similar to those of *malikuli*, *perplexus* and *mediopunctatus* in having seta 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; basal spine of meso- and meta-pleural setae well developed and long; comb scales in a row, arising from a sclerotized plate and 1-S inserted beyond last tooth and in line with the teeth. It can easily be recognized, however, by having the basal spine of the meso- and meta-pleural setae long, straight and blunt at tip, and marginal spicules very small and inconspicuous; in *malikuli*, *perplexus* and *mediopunctatus* the basal spine of the meso- and metapleural setae is long, straight and pointed at tip, and marginal spicules are well developed and conspicuous.

The pupa of *desmotes* is very similar to those of *annandalei*, *craggi*, *malikuli*, *perplexus* and *mediopunctatus* having seta 2-IV, V laterad of 1-IV, V but differs in having 2-IV, V laterad of 3-IV, V and 1-II usually with 4 branches (3-6); in *annandalei*, *craggi*, *malikuli*, *perplexus* and *mediopunctatus* seta 2-IV, V mesad of 3-IV, V and 1-II usually is well developed, with many branches and dentritic.

The immature stages are often found in association with those of *perplexus*

in the field. Great care must therefore be taken in identifying them. The discussion under *desmotes* deals with this matter.

Aedes desmotes apparently is a common species in the Southeast Asia area. It is known from eastern India, Assam, Thailand, Taiwan, Peninsular Malaysia, Kalimantan, Sulawesi and the Philippines.

BIONOMICS. The immature stages of *desmotes* have been collected mainly in bamboo internodes, split bamboos and bamboo stumps in the Philippines, Malaysia, and Thailand. At Subic Bay, Philippines, Baisas (1974) noted that *desmotes* particularly preferred tree holes and bamboos. The females have been taken biting man in deciduous forest in the mountains of Chiang Mai, Kanchanaburi and Prachin Buri provinces, Thailand. Specimens from Boeten, Sulawesi were taken attacking man between 5:30 and 8:00 P.M. The immature stages were associated with *perplexus* in Thailand.

mediopunctatus subgroup

TAXONOMIC CHARACTERS: ADULT. *Head.* Palpi with white scales.

Thorax. (1) Dorsocentral bristles absent; prescutellar bristles well developed; (2) scutum with median longitudinal white stripe broader than usual, extending from anterior margin, tapering posteriorly and forking at the beginning of prescutellar space; (3) without a patch of broad dark scales on each side of prescutellar space; (4) subspiracular and postspiracular areas with broad white scales; hypostigial, prealar and metameron areas without broad white scales; (5) scutellum with broad white scales on midlobe and with broad dark, or white, or both on lateral lobe. *Legs.* (1) Knee-spot absent on forefemur, present on mid- and hindfemora; (2) midfemur without a median white spot on anterior surface; (3) all tibiae anteriorly dark without any white band; hind tibia with white stripe on basal-ventral quarter; (4) hindtarsus with basal white bands on tarsomeres 1, 2; tarsomere 3 all dark; tarsomere 4 all white or dark at tip; tarsomere 5 varied, all white to all dark. *Male Terminalia.* (1) Tergum IX with middle part produced into a large rounded lobe; (2) paraproct without ventral arms; (3) distimere complex, slightly shorter than basimere, expanded at base and forked apically, with spiniform process. *Female Terminalia.* Tergum IX slightly broader than long to broader than long, but less than 1.5 times as wide as long, with well developed lateral lobes, each with 3-5 setae.

PUPA. *Abdomen.* (1) Seta 1-II well developed, with many branches, dendritic; (2) 2-IV, V laterad of 1-IV, V. Male genital lobe short and broad about as long as wide.

LARVA. *Thorax.* (1) Seta 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; (2) basal spine of meso- and metapleural setae long, straight and pointed at tip. *Segment VIII.* Comb scales in a row, arising from a sclerotized plate. *Siphon.* 1-S inserted beyond last tooth and in line with the teeth. *Anal Segment.* Marginal spicules long and conspicuous, each spicule usually pointed at tip.

DISTRIBUTION. Species of this subgroup are found from southwestern India, Sri Lanka, northeastern India, Thailand, Peninsular Malaysia, and southern China to Taiwan and Palawan (MAP V).

TAXONOMIC DISCUSSION. As currently interpreted, the *mediopunctatus* subgroup consists of the 4 species, *malikuli*, *mediopunctatus*, *perplexus* and *rhungkhiangensis*. All of these occur in Southeast Asia.

On present collection data, all the members of the *mediopunctatus* sub-

group in Southeast Asia occur in the Oriental area; *mediopunctatus* and *perplexus* are also known to occur in the Indomalayan area (Malaya and Palawan).

The *mediopunctatus* subgroup is well marked in the adult and larva stages. The adult shares the characteristic of the *annandalei* subgroup in pleural markings. The male terminalia share the characteristics of the *w-albus* subgroup in tergum IX with the middle part produced into a large lobe and the paraproct without ventral arms. The female terminalia are as of the *annandalei* and *w-albus* subgroups. The pupa is extremely similar to those of the *annandalei* subgroup and the female pupae are often indistinguishable from those of *annandalei* subgroup. The larva is essentially as in the *desmotes* subgroup, except that the marginal spicules of anal segment are well developed and conspicuous which is the characteristic of the *annandalei* subgroup.

Members of this subgroup are extremely variable and difficult to separate in all stages except for the male. Theobald (1905a) described *mediopunctatus* species from a single female from Peradeniya, Ceylon. The male was unknown and thus, the true identity of this species cannot be ascertained. Fortunately, a male was collected by Y.-M. Huang and E. L. Peyton from Sri Lanka (Ceylon) in 1975. Based upon an examination of the male terminalia of *mediopunctatus* from Sri Lanka, it can now be said with certainty that the Indian specimens previously described as *mediopunctatus*, *mediopunctatus* var. *submediopunctatus* (Barraud), and *mediopunctatus* var. *sureilensis* Barraud by Barraud (1923a, 1934) as well as the Philippines specimens previously described as *mediopunctatus* var. *perplexus* by Knight and Hull (1952) are all *mediopunctatus*.

Stegomyia perplexus was originally described by Leicester (1908a: 83) as a distinct species from Kuala Lumpur, Malaya. Barraud (1934: 231) considered it to be a variety of *mediopunctatus* which had the 4th and 5th hind tarsal segments entirely white and Mattingly (1965: 46) treated it as a subspecies. Based on the discovery that the male terminalia of *perplexus* differ from *mediopunctatus* by the absence of several distinctly longer and stouter setae on the tergal portion of the expanded distal part of the claspette of the basimere, I have here elevated *perplexus* to specific status.

It is now difficult to say what Lien's (1962) record of *mediopunctatus* var. *perplexus* represents. My only Taiwan male specimen (from the Bishop Museum) of the subgroup is *malikuli*. It is possible that either *mediopunctatus* or *perplexus* is also present in Taiwan. However, no conclusion can be made without examination of additional Taiwan specimens.

Chang and Chang (1974) described *Aedes (Stegomyia) rhungkiangensis* from Kweichow Province, China. Based on the descriptions of this species, I have here assigned *rhungkiangensis* to the *mediopunctatus* subgroup. Since the claspette of the male terminalia of *rhungkiangensis* was neither described in detail nor illustrated, the true identity as well as the relationship of this species to other members of the subgroup cannot be further discussed until specimens of *rhungkiangensis* become available.

However, from Chang and Chang's (1974) description of *rhungkiangensis*, this species can be recognized by the following diagnostic characters: In adult (1) ♂ scutellum without scales on all lobes; ♀ scutellum with broad white scales on midlobe and without scales on lateral lobe; (2) hindtarsomere 5 with basal half white and apical half dark; (3) claspette with numerous setae and with 2 rod-like modified setae. In larva (1) antenna with seta 1-A branched; (2) mentum with 7 teeth on each side; (3) segment VIII without a sclerotized plate.

BIONOMICS. Larvae and pupae are usually found in bamboo stumps and bamboo internodes. They are also found in split and cut bamboos. Occa-

sionally they are found in holes of stumps, logs, and trees, and leaf axils of pandanus and nipa palm. The females bite man. The immature stages are associated with the *albopictus* and *scutellaris* subgroups of the *scutellaris* group and with the *annandalei* and *desmotes* subgroups of the *w-albus* group.

AEDES (STEGOMYIA) MALIKULI HUANG
(Figs. 19; 20)

Aedes (Stegomyia) malikuli Huang 1973: 225 (♂*, P*, L*).

MALE. *Head.* Proboscis dark scaled, sometimes with a white patch at base and a few pale scales on ventral side, as long as forefemur; palpus dark, slightly longer than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short setae, antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a broad median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of broad white scales ventrally. *Thorax.* Scutum with narrow dark scales and a broad median longitudinal stripe of similar white ones which reaches from anterior margin, tapers posteriorly and forks at beginning of prescutellar space; prescutellar space surrounded by narrow white scales; a patch of broad white scales on the lateral margin just before the level of the wing root, extending forward over the paratergite and the mesothoracic spiracle toward scutal angle and backward over the wing root toward scutellum; acrostichal and dorsocentral bristles absent; prescutellar bristles well developed; scutellum with broad white scales on midlobe and broad dark scales on lateral lobe, sometimes lateral lobe with few pale broad scales as well; anterior pronotum with broad white scales; posterior pronotum with broad white scales and a few dark ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the subspiracular and postspiracular areas, on the upper and lower portions of sternopleuron and on the mesepimeron; lower mesepimeron without bristles; metameron bare. *Wing.* With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; cell R_2 twice as long as R_{2+3} . *Halter.* With dark scales. *Legs.* Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; fore- and midfemora anteriorly dark; hindfemur anteriorly with basal 0.67 white, a complete dark band present which separates the basal white stripe from the apical white scale patch, sometimes the dark band is not complete on the lower portion of anterior surface; all tibiae anteriorly dark; hindtibia with white stripe on basalventral quarter; foretarsus with basal white band on tarsomere 1; midtarsus with basal white bands on tarsomeres 1, 2; hindtarsus with basal white bands on tarsomeres 1, 2; tarsomere 3 all dark; tarsomere 4 all white, sometimes dark at tip; tarsomere 5 all dark, sometimes with a few white scales on basal area, or sometimes with basal half white; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen.* Abdominal segment I with white scales on laterotergite; terga II-VI with large basal lateral white spots; tergum II with or without a small basal median white spot; terga III-VI each with a basal white band which is not connected with the lateral spots. *Terminalia*

(Fig. 19C). Basimere short and broad, about twice as long as wide; its scales restricted to lateral and ventral areas; with numerous long setae on apicomeral area; with a patch of setae (3-10) on basomeral area of dorsal surface; claspette simple, with numerous long setae on the slightly expanded distal part and with few shorter ones on sternal side; distimere complex, expanded at base and forked apically, with setae and spiniform process; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX with middle part produced into a large rounded lobe and with a small hairy lobe on each side.

FEMALE. Unknown.

PUPA (Figs. 19A, B). *Cephalothorax*. Trumpet short, about 2.5 times as long as wide at the middle; seta 1, 3-C single, slightly longer than 2-C; 2-C single; 4, 5-C single; 6-C single, shorter than 7-C; 7-C single; 10-C 2-branched, mesad and caudad of 11-C; 11-C single, stout. *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II with many branches, dendritic; 2-II laterad of 3-II; 2-IV, V laterad of 1-IV, V; 1-III usually with 2 branches (2-4); 1-IV usually double (2-3); 3-II, III single, shorter than segment III; 5-IV-VI single, or sometimes 5-IV, V with 2 branches, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII much longer and stouter than preceding ones; 9-VII 2-branched, barbed; 9-VIII with 2 branches and barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; seta 1-P single.

LARVA (Fig. 20). *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; seta 4-C well developed, with 5-7 branches, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C single, long; 6-C double; 7-C with 2 branches; 8, 10 and 13-C single; 9-C with 2 branches; 11-C 3-branched; 12-C with 3-4 branches; 14-C double; 15-C usually double (2-3); mentum with 10-11 teeth on each side. *Thorax*. Seta 1-P usually 3-branched (2-3); 2-P single; 3-P double; 4-P single; 5, 7-P usually double (1-2); 6-P single; 9-P single; 11-P single; 14-P usually 2-branched; 5, 7-M single; 6-M 2-branched; 8-M with 2-3 branches; 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; 11-M single; 7-T with 2-3 branches; 9, 10 and 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural setae long, straight and pointed at tip. *Abdomen*. Seta 6-I, II 2-branched; 7-I single; 7-II 2-branched; 6-III-V 2-branched, one more slender than the other; 6-VI single; 7-III with 4-5 branches, small; 4-I, II 3-branched; 1-VII usually with 3 branches, barbed; 2-VII 3-branched; comb of 5 scales in a row, arising from a sclerotized plate, each scale with fine denticles at the base of the apical spine; 2-VIII distant from 1-VIII; 1, 5-VIII 3-branched; 3-VIII with 3-4 branches; 2, 4-VIII single; saddle incomplete; marginal spicules long and conspicuous; 1-X 2-branched; 2-X single; 3-X single; ventral brush with 4 pairs of setae on grid, each seta single; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like. *Siphon*. About 3 times as long as wide, acus absent; 10-18 pecten teeth, evenly spaced, each tooth with 3-5 basal denticles; 1-S with 2-3 branches, inserted beyond last tooth and in line with the teeth.

TYPE-DATA. *Aedes (Stegomyia) malikuli* Huang, holotype male, with associated larval and pupal skins and terminalia on a slide, in USNM; type-locality: Huai Phrao, *Chiang Mai*, THAILAND, 10-VII-1970 (Chaliou & Anun). Paratypes: 1 male with associated larval and pupal skins and terminalia slide,

with same data as holotype; 1 male with associated larval and pupal skins and terminalia slide, Huai Mae Nam Noi, *Kanchanaburi*, THAILAND, 25-V-1965 (Peyton); 2 males with associated pupal skins and terminalia slides, 1-VIII-1965 (Somboon), 2 males with associated larval and pupal skins and terminalia slides, 2-VIII-1965 (Kol), Doi Sam Sao, *Tak*, THAILAND; 1 male with associated pupal skin and terminalia slide, Khao Salak Phra, *Tak*, THAILAND, 1-VIII-1965 (Somboon), in USNM.

DISTRIBUTION. 34 specimens examined: 11♂, 11♂ terminalia, 8 individual rearings (4 l, 8 p).

TAIWAN. *Taichung*: Sun Moon Lake (I-VI-1948), 1♂, 1♂ terminalia.

THAILAND. *Chiang Mai*: Huai Phrao (VII-1970, Chaliou & Anun), 2♂, 2♂ terminalia, 2 individual rearings (2 l, 2 p). *Kanchanaburi*: Huai Mae Nam Noi (V-1965, Peyton), 1♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p); Ban Wang Klang (VII-1974, Kol & team), 1♂, 1♂ terminalia; Ban La Wa (VII-1974, Kol & team), 1♂, 1♂ terminalia. *Tak*: Doi Sam Sao (VIII-1965, Somboon), 2♂, 2♂ terminalia, 2 individual rearings (2 p); (VIII-1965, Kol), 2♂, 2♂ terminalia, 2 individual rearings (1 l, 2 p); Khao Salak Phra (VIII-1965, Somboon), 1♂, 1♂ terminalia, 1 individual rearing (1 p).

TAXONOMIC DISCUSSION. *Aedes malikuli*, a member of the *mediopunctatus* subgroup, is extremely similar to other species of the subgroup. However, the male terminalia of *malikuli* have the claspette simple, with numerous long setae on the slightly expanded distal part and with few shorter ones on the sternal side, thus differing from those of all other species that have been described.

On the evidence of present collection data, *malikuli* is a mountain species extremely similar to *perplexus* which is widespread in Thailand. Both species have been collected as larvae in the same tree hole from the Chiang Mai area. At present, I am unable to find any reliable characters to separate them in all stages except male terminalia.

In Thailand, the immature stages are also found in association with those of *craggi* in the field. The larva of *malikuli* can easily be distinguished from that of *craggi* by having seta 1-S inserted beyond the last pecten tooth and in line with the teeth; marginal spicules long, each spicule usually pointed at tip; in *craggi* seta 1-S is inserted about the level of, or before the last pecten tooth and dorsad of the teeth; marginal spicules are stout, each spicule rather short and bluntly rounded at tip. The pupa of *malikuli* greatly resembles *craggi*. The male pupa of *malikuli* is distinguished from that of *craggi* by having the male genital lobe short and broad, as long as wide, and without a triangular-shape fold on ventral side, whereas in *craggi* the male genital lobe is rather long and broad, slightly longer than wide and has a triangular-shape fold on ventral side.

Aedes malikuli is an Oriental species of the *mediopunctatus* subgroup. It is presently known from Thailand and Taiwan.

BIONOMICS. The immature stages of *malikuli* have been collected in bamboo internodes, in a bamboo stump, in a small tree hole and in a stream pool in Thailand. The specimens from Chiang Mai Province were found in a secondary deciduous forest in the mountains, about 393 m. The specimen from Kanchanaburi Province was found in a bamboo grove in a mountainous area, about 107 m, and the specimens from Tak Province were found in primary rain forests in the mountains from 460 to 705 m. The immature stages were associated with *craggi* and *perplexus*.

AEDES (STEGOMYIA) MEDIOPUNCTATUS (THEOBALD)
(Figs. 21C; 22; 23; 24)

Stegomyia mediopunctatus Theobald 1905a: 240 (♀).

Stegomyia mediopunctatus var. *submediopunctatus* Barraud 1923a: 781 (♀).

Stegomyia mediopunctatus Theobald, Barraud 1923a: 780 (♂*, ♀); Barraud 1923b: 226; Borel 1928: 87 (♂*, ♀, L*).

Aedes (Stegomyia) mediopunctatus (Theobald), Edwards 1932: 165; Barraud 1934: 230 (♂*, ♀*, L).

Aedes (Stegomyia) mediopunctatus var. *submediopunctatus* (Barraud), Barraud 1934: 231 (taxonomy).

Aedes (Stegomyia) mediopunctatus var. *sureilensis* Barraud 1934: 231 (♀).

Aedes (Stegomyia) mediopunctatus var. *perplexus* (Leicester), Knight and Hull 1952: 182 (♂*, ♀, L*). NEW SYNONYMY.

Aedes (Stegomyia) submediopunctatus (Barraud), Huang 1973: 231 (♂*) (taxonomy).

MALE. *Head.* Proboscis dark scaled, with a white patch at base and some pale scales on ventral side, as long as forefemur; palpus dark, slightly longer than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, up-turned, and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a broad median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax.* Scutum with narrow dark scales and a broad median longitudinal stripe of similar white ones which reaches from anterior margin, tapers posteriorly and forks at beginning of prescutellar space; prescutellar space surrounded by white narrow scales, sometimes with a few broad ones as well; a patch of broad white scales on the lateral margin just before the level of the wing root, extending forward over the paratergite and the mesothoracic spiracle toward scutal angle and backward over the wing root toward scutellum; acrostichal and dorsocentral bristles absent; prescutellar bristles well developed; scutellum with broad white scales on midlobe and broad dark scales on lateral lobe, sometimes lateral lobe with few pale broad scales as well, occasionally lateral lobe with all pale broad scales; anterior pronotum with broad white scales; posterior pronotum with broad white scales and a few narrow dark ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the subspiracular and postspiracular areas, on the upper and lower portions of sternopleuron and on the mesepimeron; lower mesepimeron without bristles; metameron bare. *Wing.* With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; cell R_2 2 times as long as R_{2+3} . *Halter.* With dark scales. *Legs.* Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; fore- and midfemora anteriorly dark; hindfemur anteriorly with basal 0.67 white, a dark triangular patch present and separates the basal white stripe from the apical white scale patch except on the lower portion of anterior surface; sometimes hindfemur with a complete dark band instead of a triangular dark patch which separates the basal white stripe from the apical white scale patch; all tibiae anteriorly dark; hindtibia with white

stripe on basal-ventral quarter; fore- and midtarsi with basal white band on tarsomere 1, sometimes midtarsus with a few white scales on basal area of tarsomere 2 as well; hindtarsus with basal white bands on tarsomeres 1, 2; tarsomere 3 all dark; tarsomere 4 all white, sometimes dark at tip; tarsomere 5 all dark, sometimes with a few white scales on basal area, or sometimes with basal half white; (Palawan specimens tarsomere 5 all white, sometimes dark at tip); fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Abdominal segment I with white scales on laterotergite; terga II-VI with basal lateral white spots; tergum II with or without a small basal median white spot; terga III-VI each with a basal white band which is not connected with the lateral spots; tergum VII without or with lateral white spots only; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia* (Fig. 21C). Basimere short and broad, about 2 times as long as wide; its scales restricted to lateral and ventral areas; with numerous long setae on apicomesal area; with or without a patch of setae on basomesal area of dorsal surface; claspette large, bilobed, with numerous setae and with a distinct stout spine-like seta on apico-sternal angle of expanded distal part and with several distinctly long and stout setae on tergal portion; distimere complex, expanded at base and forked apically, with setae and spiniform process; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX with middle part produced into a large rounded lobe and with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects: *Head*. Proboscis dark scaled, with or without a white patch at base, with some pale scales on ventral side; palpus 4-segmented, or 5-segmented, segment 5 minute, about 0.25 of proboscis, with white scales on less than apical half. *Legs*. Foretarsomere 2 sometimes with a few white scales on basal area; midtarsomere 2 sometimes with basal white band; fore- and midlegs with tarsal claws equal, all toothed. *Abdomen*. Tergum VII with lateral white spots and basal white band which is not connected with the lateral spots; segment VIII largely retracted. *Terminalia* (Figs. 22C, 24). Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 6 (3-6) larger ones on apical third; tergum IX with well developed lateral lobes, each with 3-5 setae; postgenital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA (Figs. 22A, B). *Cephalothorax*. Trumpet short, about 2.8 times as long as wide at the middle; seta 1, 3-C single, slightly longer than 2-C; 2-C usually single (1-2); 4, 5-C single (1-2); 6-C single, shorter than 7-C; 7-C usually single (1-2); 10-C with 1-3 branches, mesad and caudad of 11-C; 11-C single, stout. *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II with many branches, dendritic; 2-II laterad of 3-II; 2-IV, V laterad of 1-IV, V; 1-III usually well developed, with 2-14 branches; 1-IV usually with 2-9 branches; 3-II, III single, shorter than segment III; 5-IV-VI single or double, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; sometimes 9-VI rather stout or forked at tip; 9-VII, VIII much longer and stouter than preceding ones; 9-VII usually 2-branched (1-2), barbed; 9-VIII usually with 2 branches (2-3) and barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; seta 1-P single.

LARVA (Fig. 23). *Head*. Antenna 0.5 length of head, without spicules;

1-A inserted near middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; seta 4-C well developed, with 6-9 branches, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C single, long; 6-C usually double (1-2); 7-C usually with 2 branches (1-3); 8, 10-C single; 9-C usually with 2 branches (1-2); 11-C usually 3-branched (2-3); 12-C usually with 3 branches (2-4); 13-C single or double; 14, 15-C usually with 2-3 branches; mentum with 10-11 teeth on each side. *Thorax*. Seta 1-P with 3-4 branches; 2-P single; 3-P double; 4-P usually single (1-2); 5-P usually with 2-3 branches; 6-P single; 7-P usually double (1-2); 9-P single; 11-P single; 14-P usually double; 5, 7-M single; 6-M usually double (2-3); 8-M usually with 2-3 branches; 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; 11-M single; 7-T usually with 3 branches (2-3); 9, 10 and 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural setae long, straight and pointed at tip. *Abdomen*. Seta 6-I-II 2-branched; 7-I usually single (1-2); 7-II usually 2-branched (1-3); 6-III-V single, or sometimes 6-III-V 2-branched, one usually more slender than the other; 7-III with 4-6 branches; 6-VI usually single; 4-I, II with 2-3 branches; 1-VII usually with 2 branches (2-3), barbed; 2-VII usually with 2-3 branches (1-3); comb of 6 (4-7) scales in a row, arising from a sclerotized plate, each scale with fine denticles at the base of the apical spine; sometimes comb scale with apical spine split at tip; 2-VIII distant from 1-VIII; 1, 5-VIII usually with 2-3 branches; 3-VIII usually with 3 branches (2-4); 2, 4-VIII single; saddle incomplete; marginal spicules long and conspicuous, each spicule usually pointed at tip, sometimes transparent distally; 1-X 2-branched; 2-X single; 3-X single; ventral brush with 4 pairs of setae on grid, each seta usually single; sometimes 1 or 2 proximal ones double; no precratal tufts; anal papillae about 2.4-3.2 times as long as saddle, sausage-like. *Siphon*. Usually about 2 (1.7-3.2) times as long as wide, acus absent; 6-19 pecten teeth in a straight or irregular row, each tooth usually with 1-5 basal denticles and transparent distally; 1-S usually with 4 branches (2-4), inserted beyond last tooth and in line with the teeth.

TYPE-DATA. *Stegomyia mediopunctatus* Theobald, type-female in BMNH; type-locality: Peradeniya, *Central*, (CEYLON) SRI LANKA, X-1901 (Theobald). *Stegomyia mediopunctatus* var. *submediopunctatus* Barraud, type-female in BMNH; type-locality: Nagargali, *Belgaum District*, INDIA, 13-VIII-1921 (P. J. Barraud). *Aedes (Stegomyia) mediopunctatus* var. *sureilensis* Barraud, type-female in BMNH; type-locality: Sureil, *Darjeeling District*, INDIA, X-1922 (P. J. Barraud).

DISTRIBUTION. 216 specimens examined: 36♂, 52♀, 35♂ terminalia, 9♀ terminalia, 15 L, 42 individual rearings (27 l, 42 p).

INDIA. *Assam*: Shillong (VI-1922, P. J. Barraud), 1♂, 1♀, 1♂ terminalia. *Bombay*: *Belgaum District* - Nagargali (13-VIII-1921, P. J. Barraud), 1♀. *Bengal*: *Darjeeling District* - Sureil (X-1922, P. J. Barraud), 1♀; Sukna (III-1967, S. Ramalingam, E. D. Abraham & E. S. Abraham), 4♂, 3♀, 4♂ terminalia, 2♀ terminalia, 2 L, 5 individual rearings (3 l, 5 p); Tindahari (III-1967, S. Ramalingam, E. D. Abraham & E. S. Abraham), 3♂, 5♀, 3♂ terminalia, 2♀ terminalia, 4 L, 7 individual rearings (7 l, 7 p); Mungpoo (III-1967, S. Ramalingam, E. D. Abraham & E. S. Abraham), 9♂, 8♀, 9♂ terminalia, 4♀ terminalia, 6 individual rearings (2 l, 6 p); Pashok (III-1967, S. Ramalingam, E. D. Abraham & E. S. Abraham), 1♂, 1♀, 1♀ terminalia, 2 individual rearings (2 p).

PHILIPPINES. *Palawan*: Irahuan River (VI-1945, Rozeboom, Knight & Laffoon), 4♂, 6♀, 4♂ terminalia, 4 L, 2 individual rearings (2 l, 2 p); Puerto

Princesa (VI-X-1945, 19th MGL), 9♂, 18♀, 9♂ terminalia, 5 L, 13 individual rearings (12 l, 13 p); Mantalingalan Pinigisan (IX-1961, Noona Dan Exp. 61-62), 1♂, 1♂ terminalia; Brooks Pt., Isumbo (XII-1967-VI-1968, Alcasid team), 4♀, 2 individual rearings (1 l, 2 p); Panakan, Lapulapu (I-V-1968, Alcasid team), 1♂, 2♀, 1♂ terminalia, 2 individual rearings (2 p); Iwahig (XI-1968, Mantubig), 1♂, 1♀, 1♂ terminalia, 2 individual rearings (2 p). Philippine Islands (1945, Rozeboom, Knight & Laffoon), 1♂, 1♂ terminalia.

SRI LANKA. *Central Province*: Peradeniya (X-1901, Theobald), 1♀; *Kandy District*, Udawattekele (VI-1975, Huang & Peyton), 1♂, 1♂ terminalia, 1 individual rearing (1 p).

TAXONOMIC DISCUSSION. *Aedes mediopunctatus* is a member of the *mediopunctatus* subgroup. The adult has the scutum with the median longitudinal white stripe broader than usual, extending from the anterior margin, tapering posteriorly and forking at the beginning of prescutellar space and the hindtarsus with tarsomere 3 all dark. It can thus easily be distinguished from those of all other species except *malikuli* and *perplexus* (the other Southeast Asia members of the *mediopunctatus* subgroup). It is extremely similar to and is indistinguishable from those of *malikuli* and *perplexus* except for the male terminalia.

The male terminalia of *mediopunctatus* can easily be distinguished from those of *malikuli* by having the claspette large and bilobed, with numerous setae and with a distinct stout spine-like seta on the apicosternal angle of the expanded distal part and with several distinctly long and stout setae on the tergal portion; in *malikuli* the claspette is simple, with numerous long setae on the slightly expanded distal part and with few shorter ones on sternal side. They are closer to those of *perplexus* with the claspette large and bilobed, but can be separated by the presence of several distinctly long and stout setae on the tergal portion of the claspette.

The larva of *mediopunctatus* cannot be distinguished from either *malikuli* or *perplexus*. The pupa of *mediopunctatus* is extremely similar to those of *annandalei*, *craggi*, *malikuli* and *perplexus*. Only the male pupa of *mediopunctatus* can be separated from those of *annandalei* and *craggi* by having the male genital lobe short and broad, about as long as wide; in *annandalei* the male genital lobe is long and broad, slightly longer than wide and in *craggi* the male genital lobe has a triangular-shape fold on ventral side. The pupa of *mediopunctatus* is indistinguishable from those of *malikuli* and *perplexus*.

Aedes mediopunctatus is an Oriental species of the *mediopunctatus* subgroup. It is presently known from Sri Lanka, India and the Philippines (Palawan).

The discontinuous distribution of this species is rather unusual. Specimens of the *mediopunctatus* subgroup from parts of Southeast Asia such as China (south of Yangtze Kiang), Hong Kong, Hainan, Vietnam, Laos, Cambodia and Burma, which are absent in all collections, may help resolve this anomaly if they become available.

BIONOMICS. The immature stages of *mediopunctatus* have been collected mainly in bamboo stumps in Sri Lanka, India and the Philippines. They have also been found in cut bamboos and leaf axils of pandanus and nipa palm in the Philippines. The specimens from India were found in plain, hill and mountainous areas, from 150 to 910 m, in bamboo groves and in secondary rain forests. The specimens from the Philippines were found in similar areas, from 8 to 150 m, in bamboo groves and in secondary rain forests. The Sri Lanka male was reared from a pupa found in the stump of a large green bamboo, 1.4 m above ground level, partially shaded, in a bamboo grove, in a secondary

rain forest located in mountainous terrain, altitude 600 m. The pupa was associated with *Aedes (Stegomyia) krombeini* Huang in Sri Lanka. Females have been taken biting man in Puerto Princesa, Palawan, Philippines.

AEDES (STEGOMYIA) PERPLEXUS (LEICESTER)
(Figs. 25, 26, 27, 28)

Stegomyia perplexus Leicester 1908a: 83 (♂, ♀).

Aedes (Stegomyia) perplexus (Leicester), Edwards 1922: 464.

Aedes (Stegomyia) mediopunctatus var. *perplexus* (Leicester), Edwards 1932: 165; Barraud 1934: 231 (taxonomy); Knight and Hull 1952: 182 (♂*, ♀, L*) (misidentification); ?Lien, 1962: 627.

Aedes (Stegomyia) mediopunctatus perplexus (Leicester), Mattingly 1965: 46 (♂*, ♀*, P*, L*)(designated cotype ♂, as lectotype; cotype ♀, as allotype).

Aedes (Stegomyia) perplexus (Leicester), Huang 1973: 231 (♂*) (taxonomy).

MALE (Fig. 25A). *Head*. Proboscis dark scaled, with a white patch at base and some pale scales on ventral side, as long as forefemur; palpus dark, as long as proboscis, (or slightly longer than proboscis in some Thailand specimens), with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side, or sometimes with white scales on dorsal side as well; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a broad median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax*. Scutum with narrow dark scales and a broad median longitudinal stripe of similar white ones which reaches from anterior margin, tapers posteriorly and forks at beginning of prescutellar space; prescutellar space surrounded by white narrow scales, sometimes with a few broad ones as well; a patch of broad white scales on the lateral margin just before the level of the wing root, extending forward over the paratergite and the mesothoracic spiracle toward scutal angle and backward over the wing root toward scutellum; acrostichal and dorsocentral bristles absent; prescutellar bristles well developed; scutellum with broad white scales on midlobe and broad dark scales on lateral lobe, sometimes lateral lobe with few pale broad scales as well; (Thailand specimens sometimes have lateral lobe with all pale broad scales); anterior pronotum with broad white scales; posterior pronotum with broad white scales and a few dark ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the subspiracular and postspiracular areas, on the upper and lower portions of sternopleuron and on the mesepimeron; lower mesepimeron without bristles; metameron bare. *Wing*. With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; cell R_2 2 times as long as R_{2+3} . *Halter*. With dark scales. *Legs*. Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; fore- and midfemora anteriorly dark; hindfemur anteriorly with basal 0.67 white, a complete dark band present which separates the basal white stripe from the apical white scale patch, sometimes the dark band not complete on the lower portion of anterior surface; all tibiae anteriorly dark; hindtibia with white stripe on basal-ventral quarter; fore- and midtarsi with basal white

band on tarsomere 1, sometimes midtarsus with a few white scales on basal area of tarsomere 2 as well; hindtarsus with basal white bands on tarsomeres 1, 2; tarsomere 3 all dark; tarsomere 4 all white; tarsomere 5 all white, sometimes dark at tip, or sometimes with apical half dark; (Thailand specimens sometimes with tarsomere 5 all dark); fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Segment I with white scales on laterotergite; terga II-VI with basal lateral white spots; tergum II with or without a small basal median white spot; terga III-VI each with a basal white band which is not connected with the lateral spots; tergum VII without or with lateral white spots only; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia* (Fig. 25C). Basimere short and broad, about 2 times as long as wide; its scales restricted to lateral and ventral areas; with numerous long setae on apicomesal area; without a patch of setae on basomesal area of dorsal surface; claspette large, bilobed, with numerous setae and with a distinct stout spine-like seta on apicosternal angle of expanded distal part; distimere complex, expanded at base and forked apically, with setae and spiniform process; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX with middle part produced into a large rounded lobe and with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects: *Head*. Proboscis dark scaled, with or without a white patch at base, with some pale scales on ventral side; palpus 4-segmented, or sometimes 5-segmented, segment 5 minute, about 0.25 of proboscis, with white scales on less than apical half. *Legs*. Foretarsomere 2 sometimes with a few white scales on basal area; midtarsomere 2 sometimes with basal white band; fore- and midlegs with tarsal claws equal, all toothed. *Abdomen*. Tergum VII with lateral white spots and basal white band which is not connected with the lateral spots; segment VIII largely retracted. *Terminalia* (Figs. 26C, 28). Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 6 (3-6) larger ones on apical third; tergum IX with well developed lateral lobes each with 3 or 4 setae; postgenital plate with or without shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA (Figs. 26A, B). *Cephalothorax*. Trumpet short, about 3 times as long as wide at the middle; seta 1, 3-C single, longer than 2-C; 2-C usually single (1-2); 4, 5-C single (1-2); 6-C single, shorter than 7-C; 7-C usually single (1-2); 10-C 2-branched (2-3), mesad and caudad of 11-C; 11-C single, stout. *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II with many branches, dendritic; 2-II laterad of 3-II; 2-IV, V laterad of 1-IV, V; 1-III usually with 2 branches (1-12); 1-IV usually single (1-6); 3-II, III single, shorter than segment III; 5-IV-VI single, or sometimes 5-IV-VI with 2 branches, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; sometimes 9-VI rather stout or forked at tip; 9-VII, VIII much longer and stouter than preceding ones; 9-VII usually 2-branched (1-2), barbed; 9-VIII usually with 2 branches (2-3) and barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; seta 1-P single.

LARVA (Fig. 27). *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; seta 4-C well developed, with 6-8 branches, closer to 6-C than 5-C cephalad and mesad of 6-C; 5-C single, long; 6-C double; 7-C usually

with 2 branches (2-3); 8, 10-C single; 9-C usually with 2 branches (2-3); 11-C usually 3-branched (3-4); 12-C usually with 3-4 branches (3-6); 13-C single or double; 14, 15-C usually double; mentum with 10-12 teeth on each side.

Thorax. Seta 1-P usually 3-branched (2-3); 2-P single; 3-P double; 4-P single; 5, 7-P usually double (1-2); 6-P single; 9-P single; 11-P single; 14-P usually double; 5, 7-M single; 6-M usually with 2-3 branches; 8-M usually with 2 branches (2-3); 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; 11-M usually single (1-2); 7-T usually with 3 branches (2-3); 9, 10- and 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural setae long, straight and pointed at tip. *Abdomen.* Seta 6-I-II 2-branched; 7-I usually single (1-2); 7-II usually 2-branched (2-4); 6-III-V 2-branched, one usually more slender than the other; 7-III with 4-6 branches; 6-VI usually single; 4-I, II with 2-3 branches; 1-VII usually with 3-4 branches (2-4), barbed; 2-VII usually with 2-4 branches; comb of 5(3-7) scales in a row, arising from a sclerotized plate, each scale with fine denticles at the base of the apical spine; sometimes comb scale with apical spine split at tip; 2-VIII distant from 1-VIII; 1, 5-VIII usually with 2-3 branches; 3-VIII usually with 3-4 branches; 2, 4-VIII single; saddle incomplete; marginal spicules long and conspicuous, each spicule usually pointed at tip; 1-X usually 2-branched (1-3); 2-X single; 3-X single; ventral brush with 4 pairs of setae on grid, each seta usually single; sometimes 1 or 2 proximal ones double; no precratal tufts; anal papillae about 2.6-3.2 times as long as saddle, sausage-like. *Siphon.* Usually about 2.2 (1.9-3.3) times as long as wide, acus absent; 8-22 pecten teeth in a straight or irregular row, each tooth usually with 1-5 basal denticles and transparent distally; 1-S usually with 4 branches (2-4), inserted beyond last tooth and in line with the teeth.

TYPE-DATA. *Stegomyia perplexus* Leicester, 1 cotype-male designated lectotype, with terminalia on slide and 1 cotype-female designated allotype by P. F. Mattingly, 5-II-1964, in BMNH; type-locality: cotype-male, in jungle, The Gap, 23-IV-1904 (G. F. Leicester), cotype-female, Pahang Rd. jungle, 6 miles from Kuala Lumpur, mid-day, 27-X-1903 (G. F. Leicester), Selangor, MALAYSIA.

DISTRIBUTION. 1,256 specimens examined: 244♂, 315♀, 85♂ terminalia, 18♀ terminalia, 37 L, 511 individual rearings (255 l, 302 p).

MALAYSIA. *Peninsular Malaysia:* Selangor - Pahang Rd., 6 mi. from Kuala Lumpur (27-X-1903, G. F. Leicester), 1♀; 15 mi. Ulu Gombak (IV-1959, W. W. Macdonald), 1♂, 1♂ terminalia; Ulu Gombak (XII-1965, Ramakrishnan), 1♂, 1♂ terminalia, 1 individual rearing (1 p); (III-1968, Chia, James & Ramakrishnan), 1♀; The Gap (23-IV-1904, G. F. Leicester), 1♂, 1♂ terminalia; (IX-1966, Ramalingam & Ramakrishnan), 1♀, 1 individual rearing (1 p); (IX-1966, Ramakrishnan), 4♂, 3♀, 4♂ terminalia, 2♀ terminalia, 4 individual rearings (4 p); (IX-1966, James), 2♂, 2♀, 1♂ terminalia, 1♀ terminalia, 4 individual rearings (1 l, 4 p); Ulu Klang (III-1967, Ramakrishnan, James & Sulaiman), 1♀; Bt. Ulu Bakan (XII-1967, Chia & Ramakrishnan), 2♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p); Bt. Kutu (V-1968, James, Chia & Ramakrishnan), 10♀, 4♀ terminalia; (VI-1968, James, Chia & Sulaiman), 1♂, 4♀, 1♂ terminalia, 3♀ terminalia. *Pahang* - Bentong Rd. (III-1967, Ramakrishnan & Sulaiman), 2♀; Fraser's Hill (VI-1968, James, Chia & Sulaiman), 3♂, 1♀, 3♂ terminalia. *Perak* - Chior F. R. (X-1967, James), 1♂, 1♂ terminalia. *Kedah* - Kg. Bagan (XII-1967, James & Sulaiman), 2♂, 2♂ terminalia.

THAILAND. *Mae Hong Son:* Ban Hua Yung (IX-1966, Somboon), 1♂, 1♂ terminalia, 1 individual rearing (1 p). *Nan:* Ban Pha Man (VIII-1966, Kol), 1♂, 2♀, 1♂ terminalia, 3 individual rearings (2 p); (VIII-1966, Chaliou), 1♀,

1 individual rearing (1 p). *Surat Thani*: Ko Samui (X-1967, Kol & team), 1♀, 1 individual rearing (1 p); (XII-1968, Kol & team), 2♀, 2 individual rearings (2 p). *Lampang*: Ban Rai Na Dieo (V-1968, Harrison & team), 3♂, 4♀, 3♂ terminalia, 2 L, 9 individual rearings (1 l, 9 p); (V-1968, Harrison & Sumeth), 1♂, 1♀, 1♂ terminalia, 2 individual rearings (1 l, 2 p); (V-1968, Somboon), 2♀, 1 L, 2 individual rearings (2 p); (V-1968, Somboon & Kol), 1 L; (V-1968, Kol), 4♂, 1♀, 4♂ terminalia, 5 individual rearings (1 l, 5 p); Doi Pha Huat (V-1968, Kol), 1♂, 1♂ terminalia, 1 individual rearing (1 p); (V-1968, Harrison & team), 5♀; Huai Not (V-1968, Harrison & team), 1 L; Ban Pang La (V-1968, Harrison & team), 1♂, 1♂ terminalia, 1 individual rearing (1 p). *Pra-chin Buri*: Khao Chang Chalut (VIII-1971, SEATO), 7♀. *Chiang Mai*: Huai Phrao (IV-1970, Kol & team), 1♂, 6♀, 1♂ terminalia, 7 individual rearings (3 l, 7 p); Ban Pang Kwang (VI-1970, Kol & team), 2♀, 2 individual rearings (1 p); (VII-1970, Chaliou & Anun), 3♂, 3♂ terminalia, 3 individual rearings (1 l, 2 p); (VI-1970, Chaliou & Anun), 5♀, 5 progeny rearings: No. (A)- 3♂, 2♀, 3♂ terminalia, 5 individual rearings (5 l, 5 p); No. (B)- 13♂, 12♀, 13♂ terminalia, 4 L, 25 individual rearings (23 l, 25 p); No. (E)- 9♂, 24♀, 2♂ terminalia, 5♀ terminalia, 35 individual rearings (35 l, 35 p); No. (F)- 16♂, 8♀, 6♂ terminalia, 21 individual rearings (15 l, 21 p); No. (G)- 17♂, 22♀, 8♂ terminalia, 3♀ terminalia, 5 L, 39 individual rearings (39 l, 39 p); (SEATO Medical Research Laboratory Insectory, II-1971), 152♂, 182♀, 21♂ terminalia, 23 L, 334 individual rearings (129 l, 129 p).

TAXONOMIC DISCUSSION. *Aedes perplexus* is a member of the *mediopunctatus* subgroup. The adult differs from all the other members of the *annandalei*, *desmotes*, and *w-albus* subgroups in having the scutum with the median longitudinal white stripe broader than usual, extending from the anterior margin, tapering posteriorly and forking at the beginning of the prescutellar space, and the hindtarsus with tarsomere 3 all dark. It is extremely similar to those of *malikuli* and *mediopunctatus*, and is indistinguishable from both except for the male terminalia.

The male terminalia of *perplexus* are very similar to those of *malikuli* and *mediopunctatus* in having tergum IX with the middle part produced into the large rounded lobe, paraproct without ventral arms, and distimere complex, slightly shorter than basimere, expanded at the base and forked apically, with setae and spiniform process. They are closer to those of *mediopunctatus* in having the claspette with the distal expanded part large and bilobed, but can be distinguished by the claspette possessing numerous setae and a distinct stout spine-like seta on the apicosternal angle of the expanded distal part, and the absence of several distinctly long and stout setae on the tergal portion; in *mediopunctatus* the claspette has several distinctly long and stout setae on the tergal portion of the expanded distal part.

The larva of *perplexus* is very similar to those of *desmotes*, *malikuli* and *mediopunctatus* with seta 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; basal spine of meso- and metapleural setae long and straight; comb scales in a row, arising from a sclerotized plate; 1-S inserted beyond last tooth and in line with the teeth. The larva of *perplexus* is indistinguishable from that of *malikuli* and *mediopunctatus*. It differs from that of *desmotes* in having the basal spine of the meso- and metapleural setae pointed at the tip, and marginal spicules well developed and conspicuous. In this respect, *perplexus* is very similar to those of *annandalei* and *craggi*. However, it can easily be distinguished from both by having 1-S in line with the pecten and inserted beyond the last tooth; marginal spicules long, each spicule usually pointed at tip; in *annandalei* and *craggi*

1-S is inserted about the level of, or before last tooth and dorsad of the pecten; the marginal spicules are stout, each spicule rather short and bluntly rounded at tip.

The pupa of *perplexus* is extremely similar to those of *annandalei*, *craggi*, *malikuli* and *mediopunctatus* in having seta 1-II well developed, with many branches and dendritic; 2-IV, V laterad of 1-IV, V. Only the male pupa of *perplexus* can be separated from those of *annandalei* and *craggi* by having the male genital lobe short and broad, about as long as wide; in *annandalei* the male genital lobe is long and broad, slightly longer than wide and in *craggi* the male genital lobe has a triangular-shape fold on ventral side. The pupa of *perplexus* is indistinguishable from those of *malikuli* and *mediopunctatus*.

The immature stages are often found in association with those of *albopictus*, *desmotes*, *annandalei*, *craggi* and *malikuli* in the field. The larva of *perplexus* can easily be distinguished from that of *albopictus* by having comb scales in a row, arising from a sclerotized plate, whereas *albopictus* has comb scales in a row, without a sclerotized plate. The pupa of *perplexus*, with setae 2-IV, V laterad of 1-IV, V and 9-VII usually 2-branched (1-2), barbed, can also be distinguished from that of *albopictus* which have setae 2-IV, V mesad of 1-IV, V and 9-VII single, simple. The immature stages of *perplexus* greatly resemble those of *desmotes*, *annandalei*, *craggi* and *malikuli*. The discussion under *desmotes* and *perplexus* deals with this matter.

Aedes perplexus is apparently a common species in the Southeast Asia area. It is known from Peninsular Malaysia and Thailand.

BIONOMICS. The immature stages of *perplexus* have been collected mainly from the stumps and internodes of bamboo in Malaysia and Thailand. They have also been found in split bamboos, in a bamboo cup, and in holes from stumps, logs and trees in Thailand. The specimens from Peninsular Malaysia were found in hilly and mountainous areas, from 90 to 1,210 m, in bamboo groves and in secondary rain forests. The specimens from Thailand were found in a mountainous area, about 420 to 620 m, in bamboo groves, in secondary rain forest and deciduous forests. The females have been taken biting man in a bamboo grove and in secondary rain forests, from 200 to 600 m, in Selangor and Pahang, Peninsular Malaysia; in deciduous forests and in a bamboo grove, from 420 to 430 m, in Lampang and Chiang Mai provinces, Thailand. They have also been taken biting man in Prachin Buri and Kanchanaburi provinces, Thailand. The immature stages were associated with *albopictus*, *desmotes*, *annandalei*, *craggi* and *malikuli* in Thailand.

w-albus subgroup

TAXONOMIC CHARACTERS: ADULT. *Head.* Palpi with white scales.

Thorax. (1) Dorsocentral and prescutellar bristles absent; (2) scutum with a white broad longitudinal stripe on either side of midline, reaching from anterior margin to the middle of the scutum and fusing with the antealar white patch; or scutum with a large median white patch, or 2 lateral white patches, on anterior third of scutum; (3) with a patch of broad dark scales on each side of prescutellar space; (4) hypostigial, subspiracular, postspiracular, prealar and metameron areas with broad white scales; (5) scutellum with broad white scales on all lobes. *Legs.* (1) Knee-spot absent on forefemur, present on mid- and hindfemora; (2) midfemur with a median white spot on anterior surface; (3) all tibiae anteriorly dark without any white band; (4) hindtarsus with basal white bands on tarsomeres 1-4, tarsomere 5 with basal white band or

all dark. *Male Terminalia*. (1) Tergum IX with middle part produced into a large lobe; (2) paraproct without ventral arms; (3) distimere simple, elongate, as long as basimere, with a rather long spiniform process near apex. *Female Terminalia*. Tergum IX slightly broader than long to slightly longer than broad, with well developed lateral lobes, each with 3 or 4 setae.

PUPA. *Abdomen*. (1) Seta 1-II usually well developed, branched, dendritic, or 1-II with 2-3 branches; (2) 2-IV, V mesad of 1-IV, V. Male genital lobe short and broad, about as long as wide to rather long, longer than wide.

LARVA. *Thorax*. (1) Seta 9-M with 2-3 branches, barbed; 10, 12-M single, long, stout and barbed; (2) basal spine of meso- and metapleural setae rather small and pointed at tip. *Segment VIII*. Comb scales in a single row, without a sclerotized plate. *Siphon*. 1-S inserted beyond last tooth and in line with the teeth. *Anal Segment*. Marginal spicules very fine and inconspicuous.

DISTRIBUTION. Species of this subgroup are found from southwestern India, eastern Pakistan, Nepal, northeastern India, southern China, Hainan, Hong Kong, Thailand, Cambodia, Vietnam, Peninsular Malaysia, Sabah, Sulawesi, Alor Island, and the Philippines (MAP VI).

TAXONOMIC DISCUSSION. As currently interpreted, the *w-albus* subgroup consists of the 2 species and one subspecies *gardnerii gardnerii*, *g. imitator* and *w-albus*. All of these are found within the Southeast Asia area.

On present collection data, one member (*g. gardnerii*) of the *w-albus* subgroup in Southeast Asia occurs in the Indomalayan area and the other 2 (*gardnerii imitator* and *w-albus*) occur in the Oriental area. *Aedes gardnerii imitator* is also known to occur in the Indomalayan area (southern Thailand and Malaya).

The *w-albus* subgroup combines some of the features of the *annandalei* and *desmotes* subgroups; the adult resembles the *annandalei* subgroup in having a patch of broad dark scales on each side of prescutellar space and the *desmotes* subgroup in pleural and in scutellar markings. The male terminalia share some characteristics of the *annandalei* and *mediopunctatus* subgroups. The female terminalia are as of the *annandalei* and *mediopunctatus* subgroups. The pupa recalls the *scutellaris* group in having seta 2-IV, V mesad of 1-IV, V. The larva resembles the *desmotes* subgroup in having the marginal spicules of anal segment very small and inconspicuous.

This subgroup is well differentiated from the other subgroups of the *w-albus* group in all stages. However, the pupa and larva proper are extremely similar to those of the *scutellaris* group and are extremely difficult or impossible to distinguish.

Theobald (1907) described *argenteomaculata* from Narcondam Island (130 km from the Andaman Islands). The type of *argenteomaculata*, a single female in the BMNH, is in very poor condition and specific identification is impossible. Thus, the true identity of this species cannot be ascertained until material from Narcondam Island becomes available.

Stegomyia imitator was originally described by Leicester (1908a: 89) from Kuala Lumpur, Malaya as a distinct species. The adult of *imitator* is extremely variable, particularly in ornamentation of the vertex, scutum and hindleg. It is the most variable and widespread member of the *w-albus* subgroup. As a result, it has several synonyms. However, if topotypic material of *argenteomaculata* from Narcondam Island becomes available, it may well prove that *imitator* is a synonym, and the name *argenteomaculata* will then have to replace *imitator*.

Ludlow (1905a) described *gardnerii* species from the Philippines. Although *imitator* (Leicester) can easily be distinguished from that of *gardnerii* (Ludlow) by the scutal markings (the scutum has a large median white patch, or 2 lateral white patches, on the anterior third of the scutum, whereas in *gardnerii* the scutum has a white broad longitudinal stripe on either side of midline, reaching from anterior margin to the middle of the scutum and fusing with the antealar white patch), the male terminalia of the 2 species are apparently identical. Based on the present collection data, this adult external morphological character (the scutal markings) seems to be geographically variable. Therefore, I have here followed Mattingly (1965) in considering *imitator* as a subspecies of *gardnerii*.

BIONOMICS. Larvae and pupae are usually found in tree holes, log holes, bamboo stumps and bamboo cups. The females bite man. The immature stages are associated with the *albopictus* subgroup of the *scutellaris* group.

AEDES (STEGOMYIA) GARDNERII GARDNERII (LUDLOW)
(Figs. 17C, D; 18B, D; 21B; 29; 30; 31)

Stegomyia gardnerii Ludlow 1905a: 99 (♂, ♀).

Quasistegomyia gardnerii Ludlow, Theobald 1907: 168 (different combination).

Aedes (Stegomyia) gardneri Ludlow, Edwards 1922: 464 (lapsus).

Aedes (Stegomyia) gardnerii (Ludlow), Dyar 1920: 182 (♂); Dyar and Shannon 1925: 75; Bonne-Wepster and Brug 1932: 105 (♂, ♀); Brug 1939: 104 (♂*); Knight and Hull 1952: 172 (♂*, ♀, L) (designated lectotype); Mattingly 1965: 32 (♂, ♀*, P, L*).

MALE. *Head.* Proboscis dark scaled, with some pale scales on ventral side, slightly longer than forefemur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax.* (Figs. 17C, D). Scutum with narrow dark scales and a white broad stripe of narrow scales on either side of midline, the broad white stripe reaches from anterior margin to the middle of the scutum; sometimes a few white narrow scales on the anterior prescutal area; an antealar patch of narrow white scales present and fusing with the white broad stripe; a posterior dorsocentral white line which reaches to the middle of the scutum and fusing with the white broad stripe; prescutellar space surrounded by white narrow scales which continue forward for a short distance; a patch of broad dark scales on each side of the prescutellar space, between the prescutellar white line and the posterior dorsocentral white line; a patch of broad dark scales over the wing root and toward scutellum; acrostichal and dorsocentral bristles absent; prescutellar bristles absent; scutellum with broad white scales on all lobes; anterior pronotum with broad white scales; posterior pronotum with broad white scales and some dark similar ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the hypostigial, subspiracular, postspiracular and prealar areas, on the upper and lower portions of sternopleuron and on the mesepimer-

on; upper sternopleural scale patch connected with the prealar scale patch; lower mesepimeron without bristles; metameron with broad white scales. *Wing*. With dark scales on all veins except for a minute basal spot of white scales on the costa; cell R_2 1.5 times as long as R_{2+3} . *Halter*. With dark scales. *Legs*. Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; forefemur anteriorly dark except for a baso-ventral white line; midfemur with a median white spot on anterior surface; hindfemur anteriorly with basal 0.67 white, a dark triangular patch present which separates the basal white stripe from the apical white scale patch except on ventral side; sometimes hindfemur with a completed dark band instead of a triangular dark patch which separates the basal white stripe from the apical white scale patch; all tibiae anteriorly dark, without any white band; fore- and midtarsi with basal white bands on tarsomeres 1, 2; hindtarsus with basal white bands on tarsomeres 1-5; the ratio of the length of white band to the total length of tarsomere is 0.33, 0.40, 0.40, 0.50 and 0.50; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Segment I with white scales on laterotergite; terga II-VI with basal lateral white spots; terga III-VI each with a basal white band which is not connected with the lateral spots; sometimes tergum III with basal lateral white spots only; tergum VII with lateral white spots only or sometimes tergum VII with basal white band as well; sterna II-III largely covered with white scales; sterna IV-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia* (Fig. 29C). Basimere about 3 times as long as wide, greatly swollen on the basal half of the ventral side; its scales restricted to dorsolateral, lateral and ventral areas; with a patch of setae on the basomesal area of dorsal surface; claspette with numerous setae on the expanded distal part and occupying about half of it; with a small median mesally directed projection which bears one large seta and with 4 smaller setae near to it; distimere simple, elongate, as long as basimere; with a spiniform process and a few setae near apex; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX with middle part produced into a large lobe and with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects: *Head* (Fig. 18B). Palpus 4-segmented, about 0.25 of proboscis, with white scales on less than apical half. *Legs*. Midtarsomere 3 sometimes with a small basal white band; hindtarsomere 4 with basal at least 0.75 white, tarsomere 5 with basal at least 0.60 white; fore- and midlegs with tarsal claws equal, all toothed. *Abdomen*. Terga III-VII each with basal lateral white spots and basal white band which is not connected with the lateral spots; segment VIII completely retracted. *Terminalia* (Figs. 18D, 31). Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 6 (4-6) larger ones on apical 0.33-0.50; tergum IX with well developed lateral lobes, each with 3 or 4 setae; postgenital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA (Figs. 29A, B). *Cephalothorax*. Trumpet short, about 3 times as long as wide at the middle; seta 1, 3-C single, longer than 2-C; 2-C single; 4-C usually double (1-2); 5-C usually double (1-3); 6-C single, shorter than 7-C; 7-C single; 10-C with 2-5 branches, mesad and caudad of 11-C, 11-C single, stout. *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II branched, dendritic; 2-II

laterad of 3-II; 2-IV, V mesad of 1-IV, V; 1-III usually with 4 branches (3-5); 1-IV usually with 3 branches (2-4); 3-II, III single, shorter than segment III; 5-IV-VI single, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII much longer and stouter than preceding ones; 9-VII usually single, simple; 9-VIII usually single (1-2) and barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; seta 1-P single.

LARVA (Fig. 30). *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; seta 4-C well developed, with 6-10 branches, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C single, long; 6-C double; 7-C usually with 2 branches (2-3); 8, 9 and 13-C single; 10-C usually with 2 branches (1-2); 11-C with 3 branches; 12-C with 2-4 branches; 14-C with 2-3 branches; 15-C usually with 2 branches (2-6); mentum with 9-10 teeth on each side. *Thorax*. Seta 1-P usually 3-branched; 2-P single; 3-P double; 4-P with 3 branches; 5-P single; 6-P usually single (1-2); 7-P usually double; 9-P single; 11-P single; 14-P 3-branched; 5, 7-M single; 6-M 3-branched; 8-M with 4-5 branches; 9-M usually with 3 branches (2-3); 10, 12-M single, long, stout; 11-M single, small; 7-T with 4-6 branches; 9-T usually with 2 branches (2-3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Seta 6-I, II usually with 3 branches (3-4); 7-I usually single (1-2); 7-II usually double (2-3); 6-III-V 2-branched; 7-III with 3 branches; 6-VI single; 4-I, II with 2-3 branches; 1-VII usually with 3 branches (2-4); 2-VII single; comb of 6-10 scales in a single row, each scale with fine denticles at the base of the apical spine; 2-VIII distant from 1-VIII; 1, 5-VIII with 3-4 branches; 3-VIII with 4-6 branches; 2, 4-VIII single; saddle incomplete; marginal spicules very fine and inconspicuous; 1-X 2-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of setae on grid, each seta single; 4d-X very small and no bars; no precratal tufts; anal papillae about 2.5 times as long as saddle, sausage-like. *Siphon*. Short, about 2.4 times as long as wide, acus absent; 4-12 pecten teeth, evenly spaced, each tooth with 1-4 basal denticles; 1-S with 2-4 branches, inserted beyond last tooth and in line with the teeth;

TYPE-DATA. *Stegomyia gardnerii* Ludlow, 1 cotype male, designated lectotype by Knight and Hull (1952) in USNM; type-locality: Bulacao, Mindoro, PHILIPPINES, (Gardner). Paratypes: 1 male, 3 females, Bulacao, Mindoro, PHILIPPINES (Gardner), in USNM.

DISTRIBUTION. 494 specimens examined: 147♂, 150♀, 39♂ terminalia, 16♀ terminalia, 3 L, 83 individual rearings (56 l, 83 p).

INDONESIA. *Sulawesi*: Kalawara (I-II-1937, S. L. Brug), 4♂, 3♀, 3♂ terminalia, *Alor I.*: Idagoe (III-1926, Van Beek), 1♀.

MALAYSIA. *Malaysia*: *Sabah* - Kudat (VI-1966), 1♀; Pulau Banggi (V-1970, Ramalingam team), 2♂, 6♀, 1♂ terminalia, 2♀ terminalia, 3 individual rearings (3 l, 3 p); Kota Belud (IV-1970, Ramalingam team), 1♀; Tuaran (IV-1970, Ramalingam team), 1♀; Tambunan (IV-1970, Ramalingam team), 8♂, 5♀, 4♂ terminalia, 2♀ terminalia, 3 L, 4 individual rearings (3 l, 4 p); Tenom (IV-1970, Ramalingam team), 1♂, 3♀, 1♂ terminalia, 1♀ terminalia, 1 individual rearing (1 p); Mt. Kinabalu (III-1970, Ramalingam team), 1♀.

PHILIPPINES. *Luzon*: (V-VI-1945), 4♂, 3♀, 2♂ terminalia; Subic Bay (VI-1945, Rozeboom, Knight & Laffoon), 1♂, 4♀, 1♂ terminalia; (VII-1964, R. T. Holway), 3♀; *La Union* - Saragosa (VI-1945, A. B. Gurney), 5♀; San Fernando (1945, A. B. Gurney), 2♀; Balaoan (VI-1945, A. B. Gurney), 2♂, 2♀; Calongboyan (VI-1945, A. B. Gurney), 2♂, 1♀; Camansi (VII-1945, A. B. Gurney), 1♂; *Batangas* - (VIII-1945, 19th MGL), 1♂, 1♂ terminalia; (X-1968,

Alcasid team), 2♂, 1♀, 3 individual rearings (1 l, 3 p); *Nueva Vizcaya* - Aritao (VI-1969, Huang & Peyton), 9♂, 16♀, 1♂ terminalia, 3♀ terminalia, 25 individual rearings (17 l, 25 p); *Nueva Ecija* - Kaointalan (VI-1969, Huang & Peyton), 2♂, 5♀, 7 individual rearings (4 l, 7 p); *Mountain Province* - Lagawe (VI-1969, Huang & Peyton), 3♂, 4♀, 7 individual rearings (5 l, 7p); *Laguna* - Los Banos (VIII-1914-III-1915), 2♂, 2♀, 2♂ terminalia; Pangil (VI-VII-1969, Huang & Peyton), 19♂, 12♀, 2♂ terminalia, 3♀ terminalia, 28 individual rearings (21 l, 28 p). *Leyte*: Carigara (XI-1944, E. S. Ross), 3♂, 2♀, 1♂ terminalia, *Cebu*: Toledo (IX-1906, R. C. McGreger), 1♂, 1♂ terminalia. *Negros*: Or. (VII-1964, M. Delfinado), 2♂, 2♂ terminalia. *Mindoro*: Bulacao (Gardner), 2♂, 3♀; APO 321 (V-VI-1945, E. S. Ross), 50♂, 36♀, 4♂ terminalia, 2♀ terminalia; San Jose (III-VII-1945, E. S. Ross), 15♂, 12♀, 8♂ terminalia, 2♀ terminalia; *Oriental* - Victoria, Alcate (VII-1969, Huang & Peyton), 1♀; Naujan, San Augustin (VII-1969, Huang & Peyton), 2♂, 1♀, 1♂ terminalia, 1♀ terminalia, 3 individual rearings (3 p). *Mindanao*: San Ramon (1945, Rozeboom, Knight & Laffoon), 1♂, 1♀. *Palawan*: (X-1945, 19th MGL), 1♀; Puerto Princesa (1945), 6♀; (QC. 64.71), 1♂ terminalia slide only, no adult; Iwahig (XI-1968, Alcasid team), 1♂, 1♀, 2 individual rearings (2 l, 2 p). *Jolo Jolo*: (Maj. Ewing), 5♂, 1♀, 2♂ terminalia. *Philippine Islands*: (C. S. Banks), 2♂, 1♀, 1♂ terminalia; (1914, Ludlow), 2♀.

REMARKS. I have not seen specimens of *gardnerii* from Soemba (Brug, 1926: 475).

TAXONOMIC DISCUSSION. *Aedes g. gardnerii*, a member of the *w-albus* subgroup, differs from all other taxa in having the scutum with a white broad longitudinal stripe on either side of midline, reaching from the anterior margin to the middle of the scutum and fusing with the antealar white patch; with a patch of broad dark scales on each side of prescutellar space and scutellum with broad white scales on all lobes. It is very similar to *desmotes*, a member of the *desmotes* subgroup, in scutal and pleural markings but can easily be distinguished from it by the patch of broad dark scales on each side of prescutellar space and by the continuity of the upper sternopleural and prealar scale patches. It is also very similar to those of *annandalei*, *craggi*, *gardnerii imitator* and *w-albus* with which it shares the patch of broad dark scales on each side of the prescutellar space. It resembles *gardnerii imitator* and *w-albus* rather than *annandalei* and *craggi* in lacking prescutellar bristles, presence of broad white scales on hypostigial, subspiracular, postspiracular, prealar and metameron areas, scutellum with broad white scales on all lobes and midfemur with a median white spot on anterior surface. It can be recognized, however, by the broad white longitudinal stripe on either side of midline, reaching from anterior margin to the middle of the scutum and fusing with the antealar white patch; in *gardnerii imitator* and *w-albus* the scutum has a large median white patch, or 2 lateral white patches, on the anterior third of the scutum.

The male terminalia of *g. gardnerii* are very similar to those of *gardnerii imitator* and *w-albus* in having tergum IX with the middle part produced into a large lobe, paraproct without ventral arms, and distimere simple, elongate, as long as basimere, with a spiniform process and a few setae near the apex. The male terminalia are indistinguishable from those of *gardnerii imitator*. They can easily be distinguished from those of *w-albus* by the numerous setae on the expanded distal part of the claspette occupying about half of it; in *w-albus* the claspette has numerous broad setae on the expanded distal part, occupying about 0.67 or more of it.

The larva of *g. gardnerii* is very similar to those of *desmotes*, *gardnerii*

imitator and *w-albus* in having the marginal spicules very fine and inconspicuous. It resembles those of *gardnerii imitator* and *w-albus* in having the basal spine of the meso- and metapleural setae rather small and pointed at tip; comb scales in a single row, without a sclerotized plate and 1-S inserted beyond the last tooth and in line with the pecten. The larva of *g. gardnerii* is indistinguishable from that of *gardnerii imitator*. It differs, however, from that of *w-albus* in having the ventral brush with 4d-X single, very small, much smaller than 4a, b, c-X and no bars; in *w-albus* 4d-X is well developed, single and has bars.

The pupa of *g. gardnerii* is very similar to those of *gardnerii imitator* and *w-albus* in having seta 2-IV, V mesad of 1-IV, V. It is closer to that of *gardnerii imitator* than to that of *w-albus* with seta 1-II usually well developed, branched and dendritic. The pupa of *g. gardnerii* is indistinguishable from that of *gardnerii imitator*. It can be separated from that of *w-albus* with seta 9-I-VI small, single, simple; in *w-albus* 9-I, II are small, single, simple and 9-III-VI are strongly developed, thickened.

Aedes g. gardnerii, an Indomalayan member of the *w-albus* subgroup, is apparently confined to the Eastern part of Indomalayan area. It is presently known from the Philippines, Sabah, Sulawesi and Alor Island. In Southeast Asia it is reported here for the first time from Sabah.

BIONOMICS. The immature stages of *g. gardnerii* have been collected in tree holes and bamboo stumps in the Philippines, Sabah and Sulawesi. Baisas (1974) noted that *g. gardnerii* was usually found in bamboos and the adults were probably zoophilic at Subic Bay Naval Reservation, the Philippines.

AEDES (STEGOMYIA) GARDNERII IMITATOR (LEICESTER)
(Figs. 32A, B)

Stegomyia imitator Leicester 1908a: 89 (♀).

?*Stegomyia argenteomaculata* Theobald 1907: 184 (♀).

Stegomyia minutissima Theobald 1910a: 9 (♀). NEW SYNONYMY.

Aedes (Stegomyia) christianus Dyar 1921: 148 (♂, ♀).

Stegomyia indosinensis Borel 1928: 93 (♂, ♀). NEW SYNONYMY.

Aedes (Stegomyia) gardnerii imitator (Leicester), Mattingly 1965: 36 (♂*, ♀*, P*, L) (designated *imitator* cotype ♀, as lectotype; synonymized *christianus*).

MALE. *Head.* Proboscis dark scaled, with some pale scales on ventral side, slightly longer than forefemur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a median stripe or a median patch of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax* (Figs. 32A, B). Scutum with narrow dark scales and a large median white patch of narrow scales on anterior third of scutum; the scutal median white patch broader than long, with narrow white scales reaching to the lateral prescutal area on each side; sometimes the scutal median white patch reduced posteriorly at middle area; or sometimes the scutal median white patch completely interrupted by narrow dark scales at middle area and formed into 2 lateral white

patches; an antealar white patch present, with narrow white scales mainly and with some broad white ones on the lateral margin just before the level of the wing root; antealar white patch extending inward and reaches to dorsocentral area; sometimes a few narrow white scales on posterior dorsocentral area; prescutellar space with some narrow white scales which sometimes continue forwards for a short distance; a patch of broad dark scales on each side of prescutellar space and a patch of similar scales over the wing root and toward scutellum; acrostichal and dorsocentral bristles absent; prescutellar bristles absent; scutellum with broad white scales on all lobes; anterior pronotum with broad white scales; posterior pronotum with a large patch of broad white scales; paratergite with broad white scales; patches of broad white scales on the propleuron, on the hypostigial, subspiracular, postspiracular and prealar areas, on the upper and lower portions of sternopleuron and on the mesepimeron; upper sternopleural scale patch connected with the prealar scale patch; lower mesepimeron without bristles; metameron with broad white scales. *Wing*. With dark scales on all veins except for a minute basal spot of white scales on the costa; cell R_2 1.5 times as long as R_{2+3} . *Halter*. With dark scales. *Legs*. Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemura; forefemur anteriorly dark except for a basoventral white line; midfemur with a median white spot on anterior surface; hindfemur anteriorly with basal 0.67-0.75 white, a dark band separates the basal white stripe from the apical white scale patch; sometimes hindfemur with a dark triangular patch instead of a completed dark band which separates the basal white stripe from the apical white scale patch except on the ventral side; all tibiae anteriorly dark, without any white band; fore- and midtarsi with basal white bands on tarsomeres 1, 2; hindtarsus with basal white bands on tarsomeres 1-5; the ratio of the length of white band to the total length of tarsomere is 0.25, 0.33, 0.33, 0.33-0.50 and 0.33-0.50; sometimes tarsomere 5 all dark; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Segment I with white scales on laterotergite; terga II-VI with basal lateral white spots; terga IV-VI each with a basal white band which is not connected with the lateral spots; tergum VII with lateral white spots only or sometimes tergum VII with basal white band as well; sterna II-III largely covered with white scales; sterna IV-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia*. Basimere about 3 times as long as wide, greatly swollen on the basal half of ventral side; its scales restricted to dorsolateral, lateral and ventral areas; with a patch of setae on the basomesal area of dorsal surface; claspette with numerous setae on the expanded distal part and occupying about half of it; with a small median mesally directed projection which bears one large seta and with 3 or 4 smaller setae near to it; distimere simple, elongate, as long as basimere; with a spiniform process and a few setae near apex; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX with middle part produced into a large lobe and with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects: *Head*. Palpus 4-segmented, about 0.25 of proboscis, with white scales on less than apical half. *Thorax*. Posterior pronotum with broad white scales and some dark similar ones dorsally, or sometimes as in the male. *Legs*. Midtarsomere 3 sometimes with basal white band; hindtarsus with basal white bands on tarsomeres 1-5; the ratio of the length of white band to the total length of tarsomere is 0.25-0.33, 0.33-0.40, 0.33-0.50, 0.50-0.75 and 0.33-0.67; fore- and midlegs with tarsal claws equal, all toothed. *Abdomen*. Terga

IV-VII each with basal lateral white spots and basal white band which is not connected with the lateral spots; sometimes tergum III with basal white band as well; segment VIII completely retracted. *Terminalia*. Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 6(4-6) larger ones on apical 0.33-0.50; tergum IX with well developed lateral lobes, each with 3 or 4 setae; postgenital plate with shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA. *Cephalothorax*. Trumpet short, about 2.6 times as long as wide at the middle; seta 1, 3-C single, longer than 2-C; 2-C single; 4-C usually single (1-2); 5-C usually single (1-3); 6-C single, shorter than 7-C; 7-C usually single (1-2); 10-C usually single (1-3), mesad and caudad of 11-C; 11-C single, stout. *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II branched, dendritic; 2-II mesad of 3-II; 2-IV, V mesad of 1-IV, V; 1-III usually with 2-3 branches; 1-IV usually with 1-2 branches; 3-II, III single, shorter than segment III; 5-IV-VI single, short, not reaching beyond posterior margin of following segment; 9-I-VI small, single, simple; 9-VII, VIII much longer and stouter than preceding ones; 9-VII usually single, simple; 9-VIII usually single (1-2) and barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; seta 1-P single.

LARVA. *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; seta 4-C well developed, with 8-12 branches, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C single, long; 6-C usually single (1-2); 7-C usually with 2 branches (2-3); 8, 9 and 13-C single; 10-C usually double (1-2); 11-C usually with 2 branches (1-3); 12-C with 2-4 branches; 14-C usually double (2-3); 15-C usually with 2 branches (2-4); mentum with 9-10 teeth on each side. *Thorax*. Seta 1-P usually 3-branched; 2-P single; 3-P double; 4-P with 3 branches; 5-P single; 6-P usually single (1-2); 7-P usually double; 9-P usually single (1-2); 11-P single; 14-P with 2-3 branches; 5, 7-M single; 6-M with 2-3 branches; 8-M with 4-5 branches; 9-M usually with 2 branches (2-3); 10, 12-M single, long, stout; 11-M usually single (1-2), small; 7-T with 3-6 branches; 9-T usually with 2 branches (1-3); 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Seta 6-I, II usually with 3 branches (3-4); 7-I usually double (1-2); 7-II usually double (2-3); 6-III-V 2-branched; 7-III with 2 branches; 6-VI single; 4-I, II with 3-4 branches; 1-VII usually double (2-3); 2-VII single; comb of 5-9 scales in a single row, each scale with fine denticles at the base of the apical spine; 2-VIII distant from 1-VIII; 1, 5-VIII with 2-4 branches; 3-VIII with 3-6 branches; 2, 4-VIII single; saddle incomplete; marginal spicules very fine and inconspicuous; 1-X 2-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of setae on grid, each seta single; 4d-X very small and no bars; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like. *Siphon*. Short about 2.4 times as long as wide, acus absent; 5-16 pecten teeth, evenly spaced, each tooth with 1-4 basal denticles; 1-S with 2-4 branches, inserted beyond last tooth and in line with the teeth.

TYPE-DATA. *Stegomyia imitator* Leicester, 1 cotype female (No. 62), selected by P. F. Mattingly, 5-VII-1963 as lectotype, in BMNH; type-locality: Jungle 5 miles from Kuala Lumpur, *Selangor*, MALAYSIA, 11-II-1904 (G. F. Leicester). *Stegomyia argenteomaculata* Theobald, type-female in BMNH; type-locality: Narcondam I. (80 miles from Andaman and Nicobar Islands), Bay of

Bengal, IX-1905 (G. Rogers), *Stegomyia minutissima* Theobald, type-female in Zoological Survey of India, Indian Museum, Calcutta, India; type-locality: Sukna (500 feet base of E. Himalayas), Darjeeling District, West Bengal, INDIA, VII-1908 (Annandale). *Aedes christianus* Dyar, lectotype male (selected by Stone and Knight, 1956), lectotype male terminalia mounted on slide in USNM; type-locality: Canton, CHINA, 3-IV-1920 (C. W. Howard). Paratypes: 1 male, 1 female, with same data as lectotype, in USNM. *Stegomyia indosinensis* Borel, type-male and female non-existent; type-locality: Indochina.

DISTRIBUTION. 329 specimens examined: 81♂, 94♀, 59♂ terminalia, 6♀ terminalia, 22 L, 40 individual rearings (27 l, 40 p).

CAMBODIA. Kandal: Phnom-Penh (V-VII-1967, J. M. Klein), 3♂, 5♀, 3♂ terminalia; Chruai Chang War (XI-1967, J. M. Klein), 1♂, 1♂ terminalia. Kompong Speu: (VIII-1967, J. M. Klein), 1♂, 1♀, 1♂ terminalia. "Ari Gsatr" (V-1967, M. Delfinado), 1♀.

CHINA. Kwangtung: Canton (IV-1920, C. W. Howard), 2♂, 1♀, 1♂ terminalia. Hainan: (1934), 17♂, 16♀, 4♂ terminalia.

HONG KONG. Hong Kong: (VII-1935, R. B. Jackson), 2♀. New Territories: Taipokau (VIII-1965, Lee K. M. & Hui W. M.), 1♀.

INDIA. Bengal: Darjeeling Dist. - Sukna (III-1967, S. Ramalingam, E. S. Abraham & E. D. Abraham), 2♂, 2♂ terminalia. Bihar: Purnea (IV-1967, S. Ramalingam & E. D. Abraham), 2♂, 2♂ terminalia.

MALAYSIA. Peninsular Malaysia: Negri Sembilan - Port Dickson (VII-1958, W. W. Macdonald), 7♂, 11♀, 5♂ terminalia; Selangor - Athlone Estate (X-1954), 1♀; Rantau Panjang (I-1959), 1♂, 1♂ terminalia; Kuala Lumpur - (II-1904, G. F. Leicester), 1♀; (Dr. A. T. Stanton), 1♂, 1♀, 1♂ terminalia; (IV-1968, A. Ganapathipillai), 18♂, 18♀, 18♂ terminalia, 6♀ terminalia, 20 L, 16 individual rearings (16 l, 16 p).

NEPAL. Hetaura, 2,000 ft. (I-V-1955, W. Peters), 1♂, 1♂ terminalia.

THAILAND. Ang Thong: Ban Chawai (IV-1969, Kol & team), 1♀, 1 individual rearing (1 l, 1 p); Ban in Pra Nun (IV-1969, Kol & team), 1♀, 1 individual rearing (1 l, 1 p); Ban Bang Chao Cha (IV-1969, Kol & team), 2♂, 1♀, 1♂ terminalia, 3 individual rearings (2 l, 3 p). Ayutthaya: Ban Lau (VI-1963, Kol), 1♂, 1♂ terminalia. Chiang Mai: (I-1953, D. C. & E. B. Thurman), 1♂, 1♂ terminalia; Doi Sutep (1962-1963), 2♂, 2♀, 1♂ terminalia; (1963), 4♂, 5♀; Ban Chang Khian (III-1970, Kol & team), 1♂, 1♂ terminalia, 1 individual rearing (1 p). Chon Buri: (VIII-1963, Dr. Udaya team), 1♀; Bang Phra (IX-1968, Sanit), 1♂, 1♂ terminalia, 1 individual rearing (1 p). Khon Kaen: Phuwang (VII-1966, Chaliou), 1♂, 1♂ terminalia, 1 individual rearing (1 p). Lampang: (1968, SEATO), 1♀; Ban Pha Huat (V-1968, SEATO), 1 L; Ban Rai Na Dieo (V-1968, Harrison & team), 2♂, 1♀, 2♂ terminalia, 3 individual rearings (3 p); Ban Pang La (V-1968, Somboon), 3♀, 1 L, 1 individual rearing (1 p); Ban Nong Hiang (V-1968, Sumeth), 2♂, 2♂ terminalia, 2 individual rearings (2 p). Lamphun: (VII-1952, D. C. Thurman, Jr.), 5♀, Nakhon Nayok: (VI-1964, Kol, Sumeth & Chalong), 1♀. Nakhon Sawan: Ban-Ko (X-1968, Kol & team), 1♀; Ban Kaeng (XI-1968, Kol & team), 1♀; Ban Tak Hian Luan (XI-1968, Kol & team), 2♂, 1♀, 2♂ terminalia, 3 individual rearings (3 l, 3 p); Ban Nua Sathani (XI-1968, Kol & team), 1♂, 3♀, 1♂ terminalia, 3 individual rearings (3 l, 3 p). Prachuap Khiri Khan: Bo-Pia (IV-1968, Kol), 1♀. Surat Thani: Koh - Samui - Klong Ban Kwiau (XII-1968, Kol & team), 1♀; Ban Phang Ka (XII-1968-I-1969, Kol & team), 3♂, 1♀, 3♂ terminalia, 4 individual rearings (1 l, 4 p). Udon Thani: Ban Kau Noi (X-1962, Sripong), 1♀; (VII-VIII-1963, Pravet), 2♀. Siam: (VIII-1933, O. R. Causey), 1♂, 1♂ terminalia.

VIETNAM. *Darlac*: Ban Me Thuot (V-1960, L. W. Quate), 1♂, 1♂ terminalia. *Pleiku*: (XI-1966, R. Hochman), 1♀.

REMARKS. I have not seen specimens of *gardnerii imitator* from Poeloch Weh (as *w-albus* Brug, 1926: 475).

TAXONOMIC DISCUSSION. *Aedes gardnerii imitator*, a member of the *w-albus* subgroup, has the prescutellar bristles absent and midfemur with a median white spot on the anterior surface, and can thus easily be distinguished from all other taxa except *g. gardnerii* and *w-albus*. The adult of *gardnerii imitator* resembles that of *annandalei*, *craggi* and *w-albus* in having the scutum with a large median white patch and a patch of broad dark scales on each side of the prescutellar space. It is closer to that of *w-albus* than to those of *annandalei* and *craggi*, having the scutum with a large median white patch, or 2 lateral white patches, on the anterior third of the scutum, hypostigial, subspiracular, postspiracular, prealar and metameron areas with broad white scales, scutellum with broad white scales on all lobes, and midfemur with a median white spot on anterior surface. It differs from that of *w-albus* by having the scutal median white patch broader than long, with narrow white scales reaching to the lateral prescutal area on each side; antealar white patch with narrow white scales mainly and with some broad white ones on the lateral margin just before the level of the wing root; in *w-albus* the scutal median white patch is rather narrow and long and antealar white patch has all narrow white scales. The adult of *gardnerii imitator* is also very similar to that of *g. gardnerii*, an Indomalayan subspecies of the *w-albus* subgroup, in all respects except for the scutal markings. It can, however, easily be distinguished from *g. gardnerii* in having the scutum with a large median white patch, or 2 lateral white patches, on the anterior third of scutum, whereas in *gardnerii* the scutum has a white broad longitudinal stripe on either side of midline, reaching from the anterior margin to the middle of the scutum and fusing with the antealar white patch.

The male terminalia of *gardnerii imitator* are very similar to those of *g. gardnerii* and *w-albus*. They are indistinguishable from those of *g. gardnerii*, but can easily be distinguished from those of *w-albus* in having the claspette with numerous setae on the expanded distal part and occupying about half of it.

The larva of *gardnerii imitator* is indistinguishable from that of *g. gardnerii*, but can be separated from that of *w-albus* by having 4d-X single, very small, much smaller than 4a, b, c-X and no bars. The pupa of *gardnerii imitator* is also indistinguishable from that of *g. gardnerii*, but can be distinguished from that of *w-albus* by seta 1-II usually well developed, branched and dendritic, and 9-I-VI small, single, simple.

The immature stages greatly resemble those of *albopictus* and since the 2 often occur in the same breeding places, care must be taken in identification. The larva of *gardnerii imitator* can be distinguished from that of *albopictus* by having 4d-X which is single, very small, much smaller than 4a, b, c-X and without bars, whereas in *albopictus* 4d-X is well developed, single and with bars. The pupa of *gardnerii imitator* can be distinguished from that of *albopictus* only in the male which has the genital lobe rather long and broad, longer than wide, whereas in *albopictus* the male genital lobe is short and broad, as long as wide. The immature stages are also found in association with those of *w-albus* in the field. Thus, great care must be taken in identifying them. The discussion under *w-albus* deals with this matter.

The type of *argenteomaculata*, a single female, from Narcondam Island (128 km from the Andaman and Nicobar islands), in the BMNH, is in very poor condition and its true identity cannot be ascertained until material from

Narcodam Island becomes available.

Aedes gardnerii imitator is apparently a common species in the Oriental area and extends into the western part of the Indomalayan area. It is presently known from Nepal, northeastern India, southern China, Hainan, Hong Kong, Thailand, Cambodia, Vietnam and Peninsular Malaysia (Malaya). In Southeast Asia it is reported here for the first time from Hong Kong and Cambodia (Kandal, Kompong, Speu).

Due to the lack of specimens from certain important areas, the taxonomic status of *imitator* and the problem as to whether or not it may be conspecific with or specifically distinct from *gardnerii* can not be definitely determined. For the present, I regard *imitator* as a subspecies of *gardnerii* on the basis of the scutal markings, the only character that *imitator* can be distinguished from *gardnerii* as described above. This morphological character seems to be geographically variable. Specimens of the *w-albus* subgroup from parts of the Indomalayan area such as Sarawak and Kalimantan, which are absent in all collections, are essential in determining the taxonomic status of this form.

BIONOMICS. The immature stages of *gardnerii imitator* have been collected mainly in log holes and bamboo cups in Thailand and from a tree hole in India. They have also been found in a stump hole, a bamboo stump, a bamboo pot and in domestic water jars in Thailand. The Malaysian larvae were obtained from eggs laid by wild caught females in the laboratory. The specimens from India were found in plain and hill areas, about 60-180 m, in secondary rain forest and in bamboo groves. The specimens from Thailand were found in plain, hill, valley and mountainous areas, about 10-520 m, in secondary deciduous forests and rain forests, in orchard plantations in villages and in bamboo groves. The females have been taken biting man in secondary forests in mountain area, about 60 m, in Prachuap Khiri Khan Province and in an orchard plantation in village, in Nakhon Sawan Province, Thailand. They have also been taken biting man in Chiang Mai, Chon Buri, Kanchanaburi and Udon Thani provinces, Thailand. The immature stages were often associated with *albopictus* and once with *w-albus*.

AEDES (STEGOMYIA) W-ALBUS (THEOBALD)
(Figs. 32C, D; 33; 34; 35)

Stegomyia w-alba Theobald 1905b: 74 (♀*).

Stegomyia w-alba Theobald, Barraud 1923: 782 (♂*, ♀*).

Aedes (Stegomyia) w-albus (Theobald), Edwards 1922: 465; Barraud 1934: 232 (♂*, ♀*); Rajagopalan 1956: 481 (P*, L*).

MALE. *Head.* Proboscis dark scaled, with some pale scales beneath, slightly longer than forefemur; palpus dark, longer than proboscis, with white basal band on each of segments 2-5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short setae; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally. *Thorax* (Figs. 32C, D). Scutum with narrow dark scales and a large median white patch of narrow scales on anterior third of scutum; the scutal median white patch rather narrow and long, sometimes

reduced at middle posteriorly; or sometimes the scutal median white patch completely interrupted by narrow dark scales at middle area and formed 2 lateral white patches; an antealar white patch present, with all narrow white scales, extending forward toward scutal angle area and inward toward dorso-central area; sometimes antealar white patch connected with the scutal white patch and formed a W-shaped white marking; sometimes a few narrow white scales on posterior dorsocentral area; prescutellar space with some narrow white scales; a patch of broad dark scales on each side of prescutellar space and a patch of similar scales over the wing root and toward scutellum; acrostichal and dorsocentral bristles absent; prescutellar bristles absent; scutellum with broad white scales on all lobes; anterior pronotum with broad white scales; posterior pronotum with broad white scales and some dark ones anteriorly and dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the hypostigial, subspiracular, postspiracular and prealar areas, on the upper and lower portions of sternopleuron and on the mesepimeron; upper sternopleural scale patch connected with the prealar scale patch; lower mesepimeron without bristles; metameron with broad white scales. *Wing*. With dark scales on all veins except for a minute basal spot of white scales on the costa; cell R_2 1.5 times as long as R_{2+3} . *Halter*. With dark scales. *Legs*. Coxae with patches of white scales; knee-spot absent on forefemur, present on mid- and hindfemora; forefemur anteriorly dark except for a baso-ventral white line; midfemur with a median white spot on anterior surface; hindfemur anteriorly with basal 0.67 white, a dark band separates the basal white stripe from the apical white scale patch; all tibiae anteriorly dark, without any white band; foretarsus with basal white bands on tarsomeres 1, 2; mid-tarsus with basal white bands on tarsomeres 1-3; hindtarsus with basal white bands on tarsomeres 1-4; the ratio of the length of white band to the total length of tarsomere is 0.33-0.40, 0.40, 0.40-0.50 and 0.67-0.75; tarsomere 5 all dark, or sometimes tarsomere 5 with basal third white; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Segment I with white scales on laterotergite; terga II-VI with basal lateral white spots; terga III-VI each with a basal white band which is not connected with the lateral spots; sometimes tergum II with basal white band as well; tergum VII with lateral white spots only or sometimes tergum VII with basal white band as well; sternum II largely covered with white scales; sterna III-VI with basal white bands; sternum VIII largely covered with white scales. *Terminalia* (Fig. 33C). Basimere about 3 times as long as wide, greatly swollen on the basal half of ventral side; its scales restricted to dorsolateral, lateral and ventral areas; with a patch of setae on the basomesal area of dorsal surface; claspette with numerous widened setae on the expanded distal part and occupying about 0.67 or more of it; with a small median mesally directed projection which bears one large seta and with 3 or 4 smaller setae near to it; distimere simple, elongate, as long as basimere; with a spiniform process and a few setae near apex; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX with middle part produced into a large lobe and with a small hairy lobe on each side.

FEMALE. Essentially as in the male, differing in the following respects: *Head*. Palpus 4-segmented, about 0.25 of proboscis, with white scales on less than apical half. *Thorax*. Posterior pronotum with a patch of broad white scales, sometimes mixed with a few narrow white scales anteriorly and some dark broad scales anteriorly and dorsally. *Wing*. Cell R_2 2 times as long as R_{2+3} . *Legs*. Hindtarsus with basal white bands on tarsomeres 1-4; the ratio

of the length of white band to the total length of tarsomere is 0.40, 0.50, 0.50 and 0.75-0.83; tarsomere 5 all dark; fore- and midlegs with tarsal claws equal, all toothed. *Abdomen*. Terga II-VII each with basal lateral white spots and basal white band which is not connected with the lateral spots; segment VIII completely retracted. *Terminalia* (Fig. 35). Sternum VIII with a deep U-shaped notch at middle and with conspicuous rounded lateral lobes; insula longer than broad, with minute setae and with 4 (4-6) larger ones on apical 0.33-0.50; tergum IX with well developed lateral lobes, each with 3 or 4 setae; postgenital plate with or without shallow notch; cerci short and broad; 3 spermathecae, one larger than the other 2.

PUPA. (Figs. 33A, B). *Cephalothorax*. Trumpet short, about 2.5 times as long as wide at the middle; seta 1, 3-C single, longer than 2-C; 2-C single; 4-C usually double (2-3); 5-C usually double (2-4); 6-C single, shorter than 7-C; 7-C usually double (1-2); 10-C with 2 branches, mesad and caudad of 11-C; 11-C single, stout. *Abdomen*. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them same as distance between 4, 5-I; 1-II with 2 or 3 branches; 2-II mesad of 3-II; 2-IV, V mesad of 1-IV, V; 1-III usually with 2 branches (2-4); 1-IV usually with 2-4 branches; 3-II, III single, shorter than segment III; 5-IV-VI single, short, not reaching beyond posterior margin of the following segment; 9-I, II small, single, simple; 9-III-VIII strongly developed, thickened; 9-VI-VIII much longer and stouter than preceding ones; 9-VI single, simple; 9-VII usually single, simple; 9-VIII usually single and barbed, reaching beyond fringe of paddle. *Paddle*. Margins with fringe; seta 1-P single.

LARVA (Fig. 34). *Head*. Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single, small, spine-like; seta 4-C well developed, with 8-10 branches, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C single, long; 6-C double; 7-C with 2 branches; 8, 9, 10 and 13-C single; 11-C with 2-3 branches; 12-C with 3-4 branches; 14-C double; 15-C with 2-3 branches; mentum with 8 teeth on each side. *Thorax*. Seta 1-P 3-branched; 2-P single; 3-P double; 4-P with 6 branches; 5-P single; 6-P single; 7-P double; 9-P single; 11-P single; 14-P 3-branched; 5, 7-M single; 6-M 3-branched; 8-M with 3 branches; 9-M double; 10, 12-M single, long, stout; 11-M single, small; 7-T with 4 branches; 9-T double; 10, 11-T similar to those on mesothorax; 12-T much reduced. *Abdomen*. Seta 6-I with 3 branches; 6-II double; 7-I single; 7-II with 4 branches; 6-III-VI single; 7-III with 3 branches; 4-I, II with 4-5 branches; 1-VII with 3 branches; 2-VII single; comb of 5-6 scales in a single row, each scale with fine denticles at the base of the apical spine; 2-VIII distant from 1-VIII; 1, 5-VIII with 2-3 branches; 3-VIII with 4 branches; 2, 4-VIII single; saddle incomplete; marginal spicules very fine and inconspicuous; 1-X 3-branched; 2-X 2-branched; 3-X single; ventral brush with 4 pairs of setae on grid, each seta single; no precratal tufts. *Siphon*. Short, about 1.7 times as long as wide, acus absent; 4-8 pecten teeth, evenly spaced, each tooth with 1-4 basal denticles; 1-S with 2 branches, inserted beyond last tooth and in line with the teeth.

TYPE-DATA. *Stegomyia w-alba* Theobald, type-female in Mayyar Nemzeti Múzeum, Budapest, Hungary; type-locality: Matheran, India Orientalia, 1902 (Biro).

DISTRIBUTION. 66 specimens examined: 14♂, 24♀, 12♂ terminalia, 12♀ terminalia, 3 individual rearings (1 l, 3 p).

INDIA. *India*: (labeled as compared with type), 1♀. *Bombay*: (VII-1921, P. J. Barraud), 3♂, 2♀, 1♂ terminalia; (6-VII-1921, P. J. Barraud), 3♂,

2♀, 3♂ terminalia, 1♀ terminalia.

PAKISTAN. *Lahore*: (1962, D. J. Gould), 5♂, 7♀, 4♂ terminalia, 4♀ terminalia.

THAILAND. *Chiang Mai*: Chang Kien (VI-1962, Preecha), 1♀, 1♀ terminalia. *Khon Kaen*: Phuwiang (VII-1966, Chaliou), 1♂, 1♀, 1♂ terminalia, 1♀ terminalia, 2 individual rearings (2 p). *Lampang*: (1968, SEATO), 1♀, 1♀ terminalia; Ban Pang La (V-1968, Harrison & Kol), 1♂ terminalia, 1 individual rearing (1 l, 1 p). *Lamphun*: (IX-1965, L. W. Quate), 1♂, 1♂ terminalia. *Nakhon Ratchasima*: Pak Thong Chai (1963, SEATO), 1♀, 1♀ terminalia. *Nakhon Sawan*: Khao Luang Nua (XI-1968, Kol & team), 2♀, 1♀ terminalia. *Udon Thani*: (VIII-1963, Pravet), 1♀, 1♀ terminalia; Ban Nong Bua (VIII-1963, Pravet), 1♀.

VIETNAM. *Khanh Hoa*: Cam Ranh 4158, 4159, 4162, 4733 (V-VII-1967, R. Hochman), 1♂, 3♀, 1♂ terminalia, 1♀ terminalia. *Pleiku*: Cheo Reo (VII-1966, 20th PMU), 1♀.

TAXONOMIC DISCUSSION. *Aedes w-albus* is a member of the *w-albus* subgroup. The adult differs from all the other members of the *annandalei*, *desmotes*, and *mediopunctatus* subgroups in having prescutellar bristles absent and the midfemur with a median white spot on the anterior surface. It is very similar to those of *g. gardnerii* and *gardnerii imitator*, the other members of the *w-albus* subgroup, in having the scutum with a patch of broad dark scales on each side of the prescutellar space; an antealar white patch present; hypostigial, subspiracular, postspiracular, prealar and metameron areas with broad white scales and scutellum with broad white scales on all lobes. However, it can easily be distinguished from that of *g. gardnerii* by the presence of a large median white patch, or 2 lateral white patches, on the anterior third of the scutum; in *g. gardnerii* the scutum has a white broad longitudinal stripe on either side of midline, reaching from anterior margin to the middle of the scutum and fusing with the antealar white patch. It can also be distinguished from that of *gardnerii imitator* by the diagnostic characters mentioned under the discussion of that form.

The male terminalia of *w-albus* are also very similar to those of *g. gardnerii* and *gardnerii imitator*; they can, however, easily be distinguished from both by the presence of numerous widened setae on the expanded distal part of the claspette occupying about 0.67 or more of it; in *g. gardnerii* and *gardnerii imitator* the claspette has numerous setae on the expanded distal part, occupying about half of it.

The larva of *w-albus* is very similar to those of *g. gardnerii* and *gardnerii imitator*, it can, however, be distinguished from both by 4d-X which is single, well developed and with bars; in *g. gardnerii* and *gardnerii imitator* 4d-X is single, very small, much smaller than 4a, b, c-X and without bars. The pupa of *w-albus* is also very similar to those of *g. gardnerii* and *gardnerii imitator*. However, it can easily be distinguished from both by seta 1-II which has 2 or 3 branches; 9-I, II which are small, single, simple and 9-III-VI strongly developed, thickened; in *g. gardnerii* and *gardnerii imitator* seta 1-II is well developed, branched and dendritic and 9-I-VI are small, single, simple.

The immature stages are found in association with those of *albopictus* and *gardnerii imitator* in the field. The larva of *w-albus* is indistinguishable from that of *albopictus*. The pupa of *w-albus* can easily be distinguished from that of *albopictus* by having seta 9-I, II, small, single, simple and 9-III-VI strongly developed, thickened, whereas in *albopictus* has 9-I-VI small, single, simple. The immature stages of *w-albus* greatly resemble those of *gardnerii imitator* but they can be distinguished by the diagnostic characters mentioned

under the discussion of *w-albus*.

Aedes w-albus is an Oriental species of the *w-albus* subgroup. It is presently known from eastern Pakistan, India, Thailand and Vietnam. In Southeast Asia it is reported here for the first time from Thailand (Chiang Mai, Khon Kaen, Lampang, Lamphun, Nakhon Ratchasima, Nakhon Sawan, Udon Thani) and Vietnam (Khanh Hoa, Pleiku).

BIONOMICS. The immature stages of *w-albus* have been collected in a small tree hole in secondary scrub, in the plains, about 200 m and in a hollow log on the ground in a mountainous area, about 410 m, in Thailand. The females have been taken biting man in a garden in Chiang Mai Province and in secondary deciduous forest in a mountainous area, about 700 m in Nakhon Sawan Province, Thailand. The immature stages were associated with *albopictus* and *gardnerii imitator*.

Bhat (1975) collected adults that were hovering adjacent to and biting humans indoors and outdoors, and in forest and semiforest environments between 0600 and 2000 hrs. A few adults were also collected while resting indoors and from forest vegetation in the Himalayan region of Uttar Pradesh, India.

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to Dr. Ronald A. Ward, Dr. Peter F. Mattingly, Dr. Bruce F. Eldridge, Dr. Douglas J. Gould and Mrs. Rampa Rattanarithkul for a critical review of the manuscript and for their valuable comments.

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APPENDIX A. PRESENT STATUS OF THE *AEDES (STEGOMYIA) EDWARDSI*
GROUP OF SPECIES

SPECIES	STAGES					BIOLOGY
	A					
	♂	♀	P	L	E	
<i>edwardsi</i>	X*	X*	-	-	-	Unknown
<i>robinsoni</i> ¹	X*	-	X*	X*	-	Larval habitats known
<i>seampi</i>	-	X*	-	-	-	Unknown
<i>tulagiensis</i> ¹	X*	X	X*	X*	-	Larval habitats known

X* = Stage or sex described and illustrated.

- = Stage or sex unknown.

X = Stage or sex described.

¹ = South Pacific species.

APPENDIX B. PRESENT STATUS OF THE *AEDES (STEGOMYIA) W-ALBUS* GROUP OF SPECIES

SPECIES	STAGES					BIOLOGY
	A ♂	A ♀	P	L	E	
ANNANDALEI SUBGROUP						
<i>annandalei</i>	X*	X*	X*	X*	-	Larval habitats known Female bites man
<i>craggi</i>	X*	X*	X*	X*	-	Larval habitats known Female bites man
DESMOTES SUBGROUP						
<i>desmotes</i>	X*	X*	X*	X*	-	Larval habitats known Female bites man
MEDIOPUNCTATUS SUBGROUP						
<i>malikuli</i>	X*	-	X*	X*	-	Larval habitats known
<i>mediopunctatus</i>	X*	X*	X*	X*	-	Larval habitats known Female bites man
<i>perplexus</i>	X*	X*	X*	X*	-	Larval habitats known Female bites man
<i>rhungkiangensis</i>	X*	X	-	X*	-	Unknown
W-ALBUS SUBGROUP						
<i>gardnerii gardnerii</i>	X*	X*	X*	X*	-	Larval habitats known
<i>gardnerii imitator</i>	X*	X*	X*	X	-	Larval habitats known Female bites man
<i>w-albus</i>	X*	X*	X*	X*	-	Larval habitats known Female bites man

X* = Stage or sex described and illustrated.

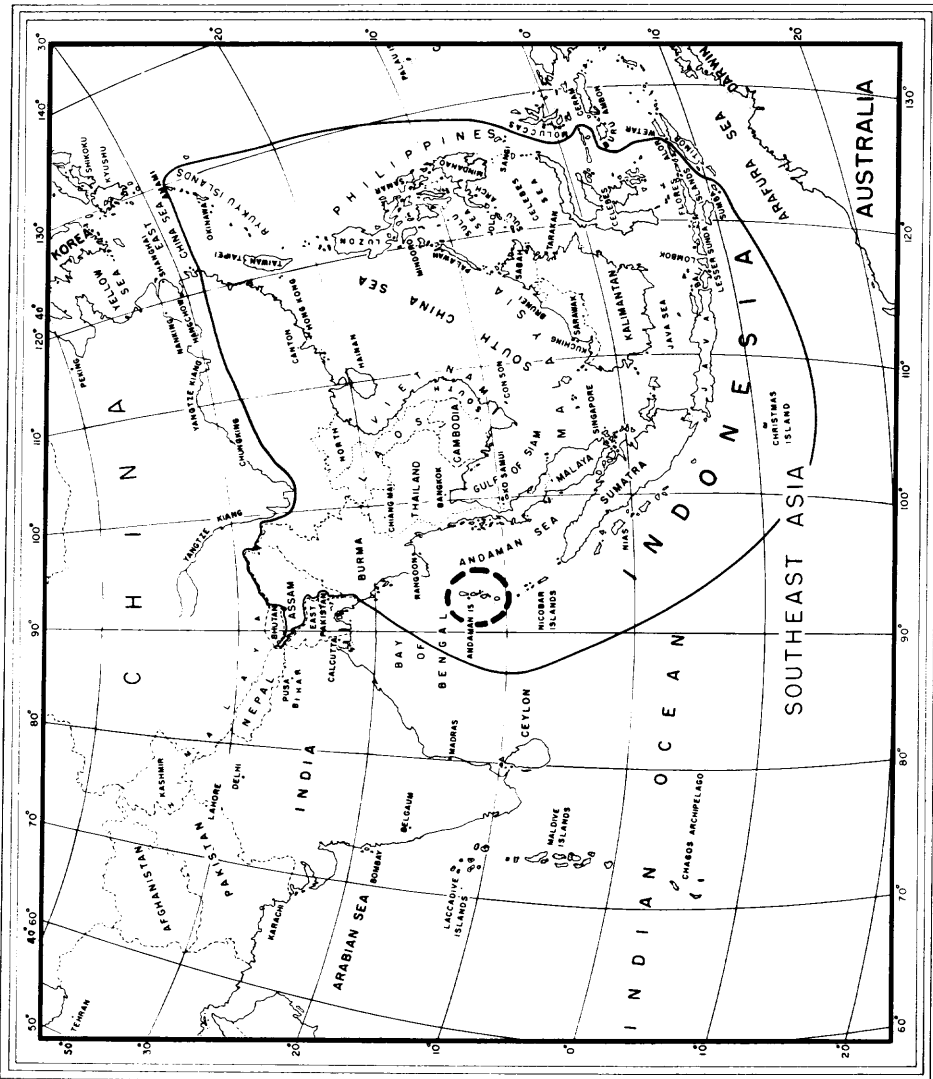
- = Stage or sex unknown.

X = Stage or sex described.

LIST OF MAPS

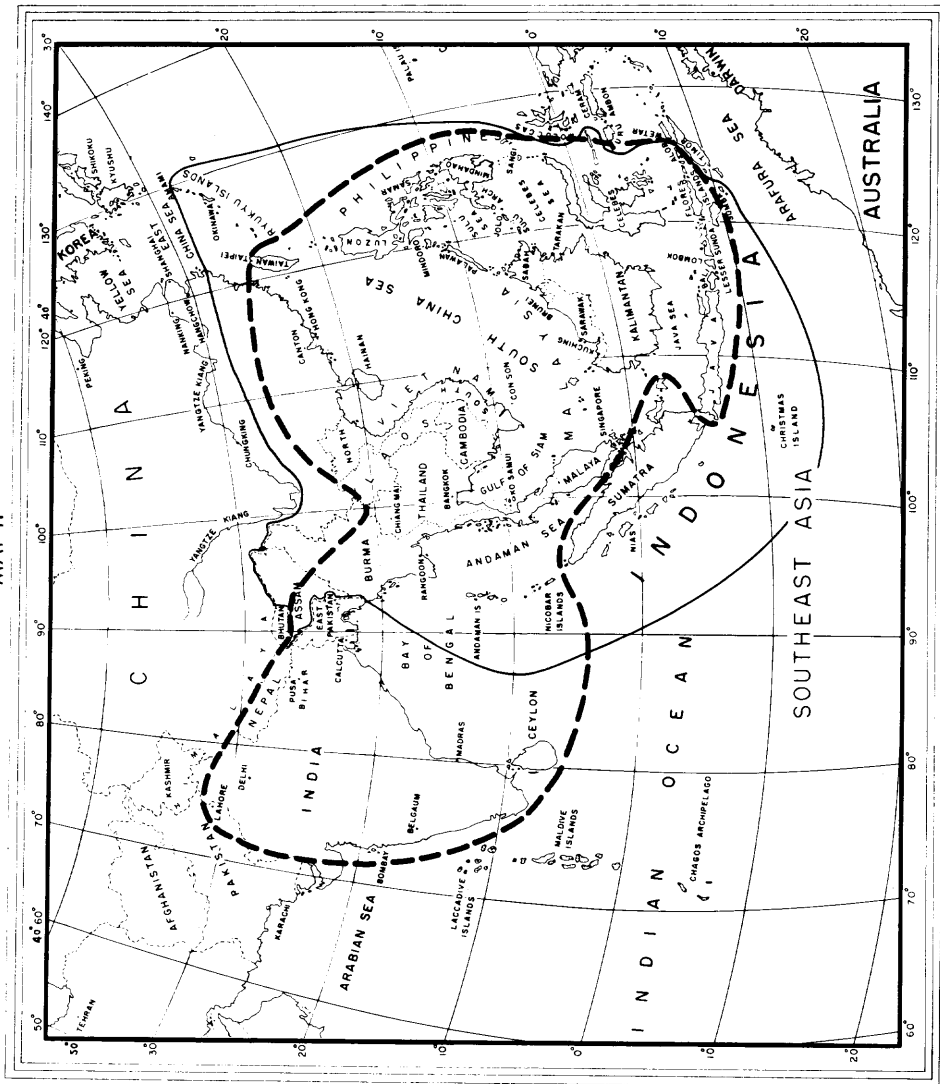
1. Distribution of the *EDWARDSI* GROUP.
2. Distribution of the *W-ALBUS* GROUP.
3. Distribution of the *annandalei* subgroup.
4. Distribution of the *desmotes* subgroup.
5. Distribution of the *mediopunctatus* subgroup.
6. Distribution of the *w-albus* subgroup.

MAP I



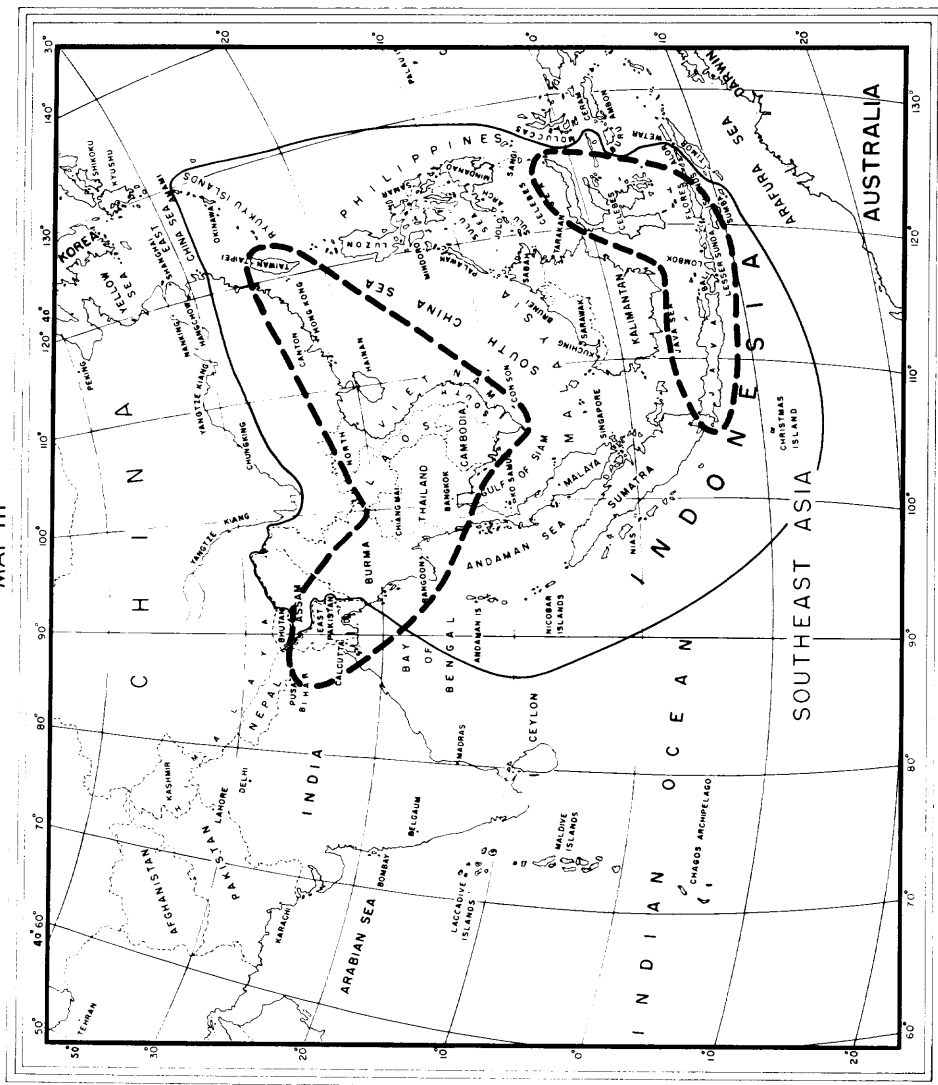
--- THE EDWARDS/ GROUP

MAP II



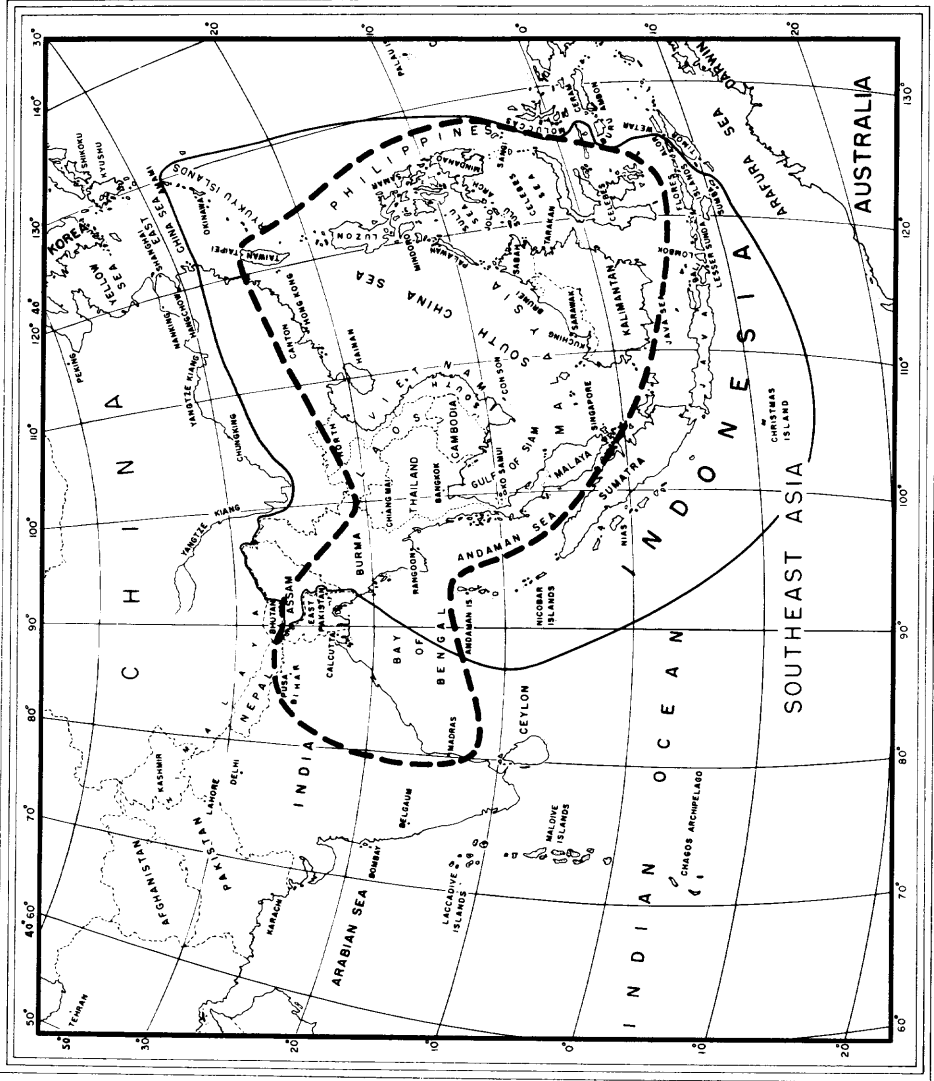
----- THE W-ALBUS GROUP

MAP III



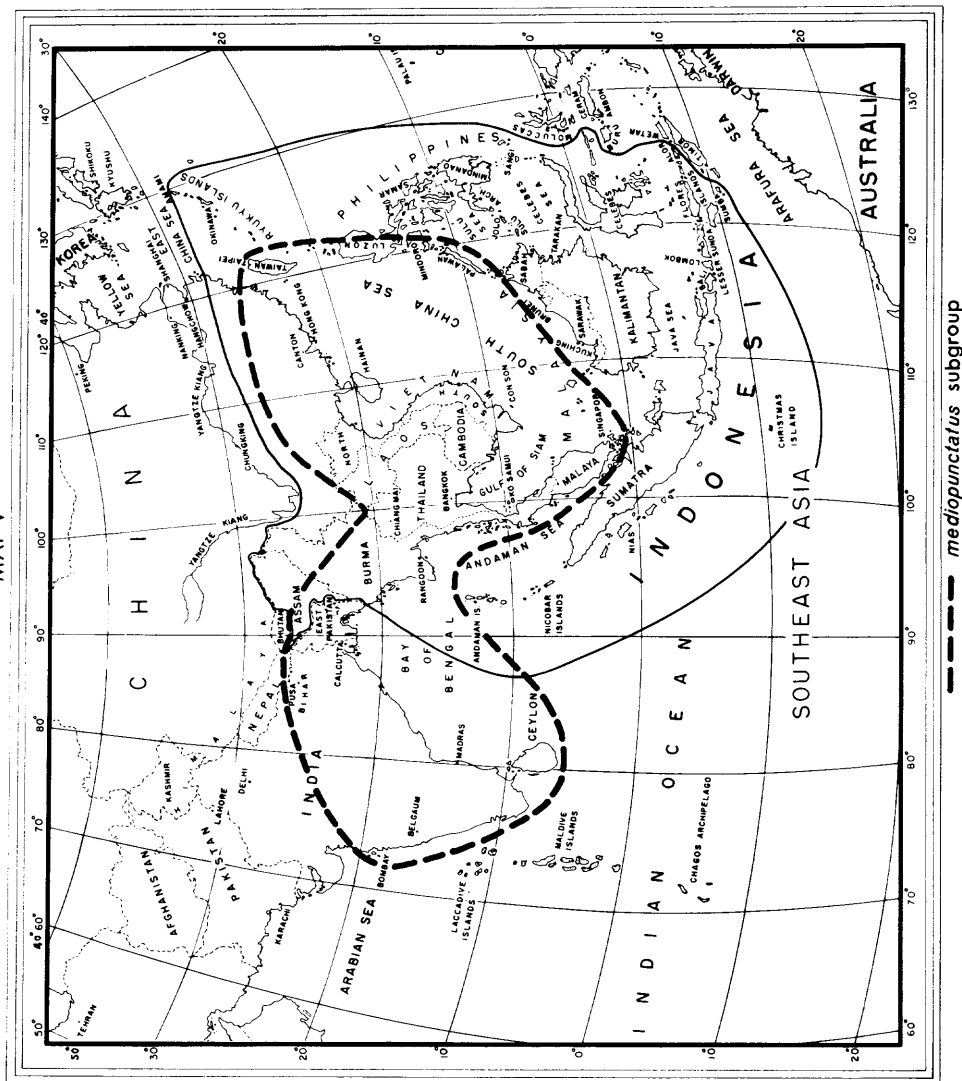
--- annandalei subgroup

MAP IV

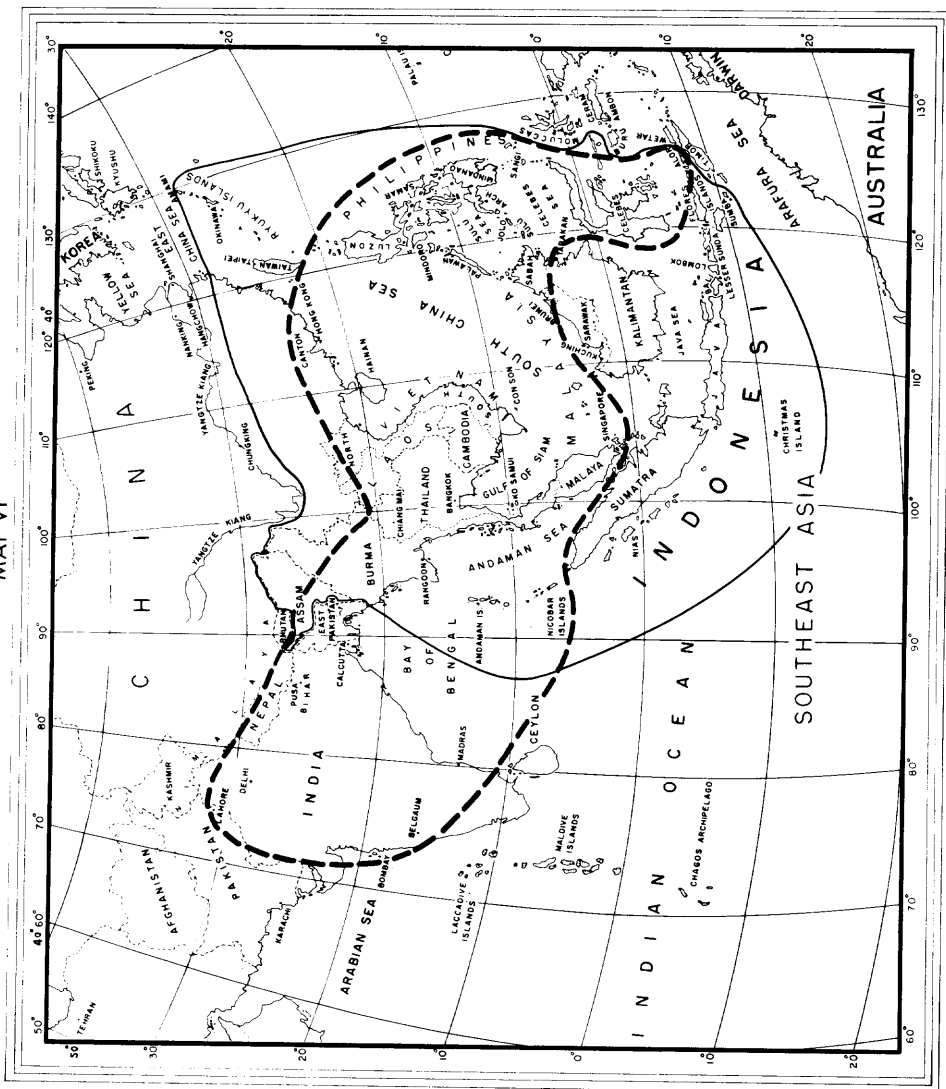


--- desmotes subgroup

MAP V



MAP VI

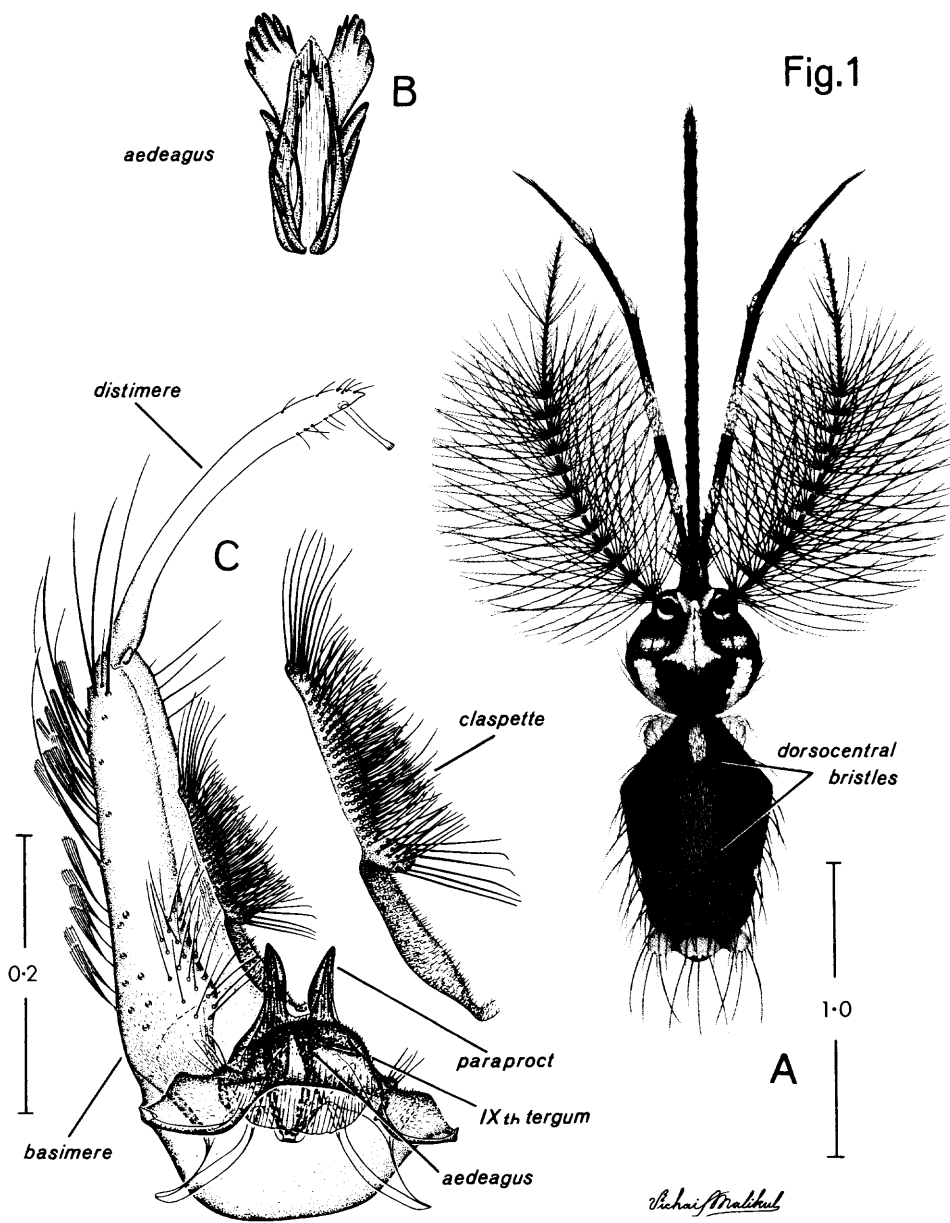


----- *w-albus* subgroup

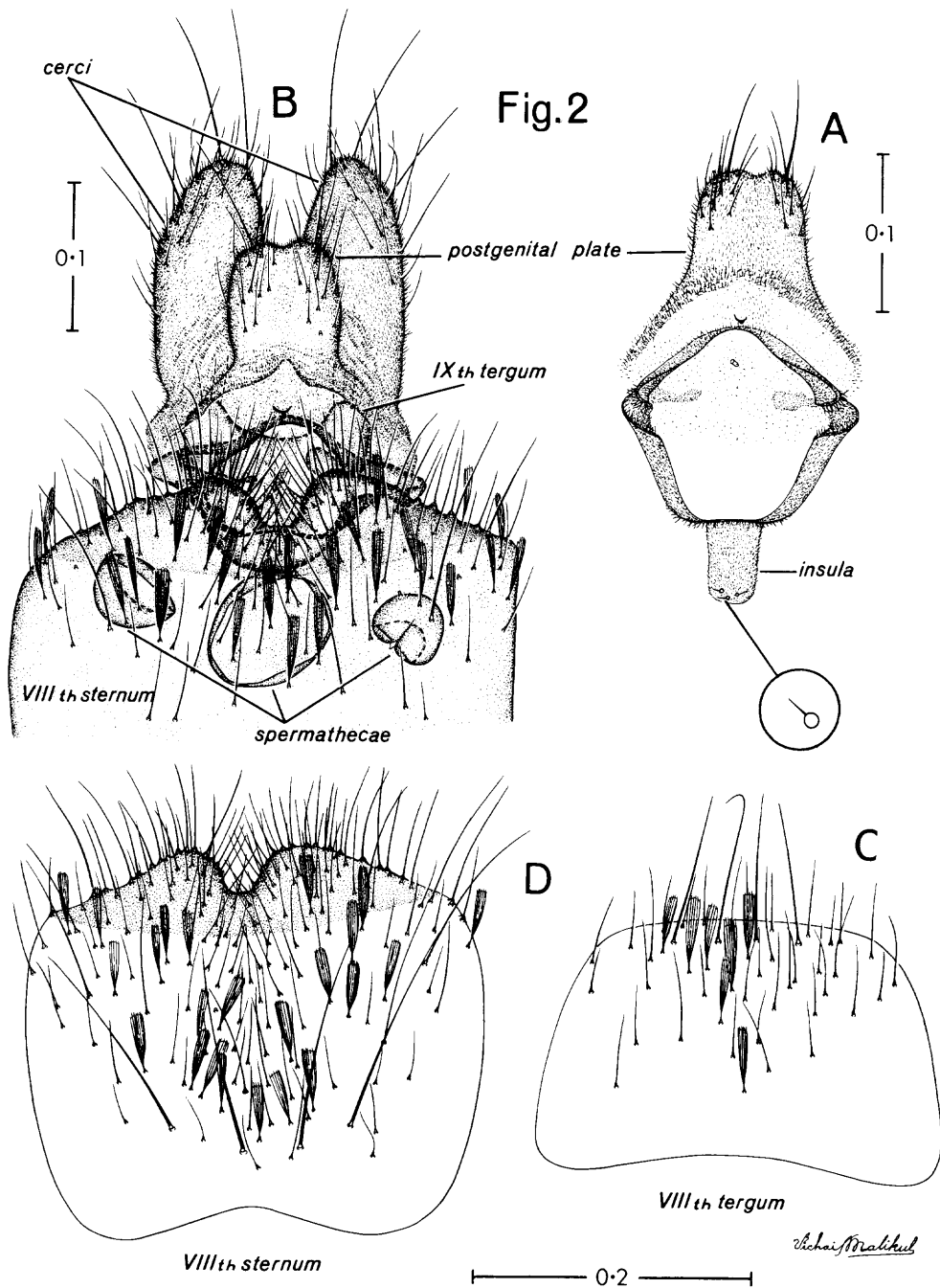
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3. *Aedes (Stegomyia) edwardsi* (Barraud) A, female palpus; B, female head; C, male hindleg; D, female hindleg;
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4. *Aedes (Stegomyia) edwardsi* (Barraud) A, B, female abdomen; C, thorax;
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6. *Aedes (Stegomyia) annandalei* (Theobald) A, B, pupa; C, male terminalia.
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8. *Aedes (Stegomyia) annandalei* (Theobald) A, B, C, D, female terminalia.
9. *Aedes (Stegomyia) annandalei* (Theobald) A, B, thorax;
Aedes (Stegomyia) craggi (Barraud) C, D, thorax.
10. *Aedes (Stegomyia) annandalei* (Theobald) A, female terminalia; B, claspette;
Aedes (Stegomyia) craggi (Barraud) C, female terminalia; D, claspette.
11. *Aedes (Stegomyia) craggi* (Barraud) A, B, pupa; C, male terminalia.
12. *Aedes (Stegomyia) craggi* (Barraud) A, B, C, larva.
13. *Aedes (Stegomyia) craggi* (Barraud) A, B, C, D, female terminalia.
14. *Aedes (Stegomyia) desmotes* (Giles) A, B, pupa; C, male terminalia.
15. *Aedes (Stegomyia) desmotes* (Giles) A, B, C, larva.
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17. *Aedes (Stegomyia) desmotes* (Giles) A, B, thorax;
Aedes (Stegomyia) gardnerii (Ludlow) C, D, thorax.
18. *Aedes (Stegomyia) desmotes* (Giles) A, female palpus; C, female terminalia.
Aedes (Stegomyia) gardnerii (Ludlow) B, female palpus; D, female terminalia.
19. *Aedes (Stegomyia) malikuli* Huang A, B, pupa; C, male terminalia.
20. *Aedes (Stegomyia) malikuli* Huang A, B, C, larva.
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Aedes (Stegomyia) mediopunctatus (Theobald) C, male terminalia; D, claspette.
22. *Aedes (Stegomyia) mediopunctatus* (Theobald) A, B, pupa; C, female terminalia.
23. *Aedes (Stegomyia) mediopunctatus* (Theobald) A, B, C, larva.
24. *Aedes (Stegomyia) mediopunctatus* (Theobald) A, B, C, D, female terminalia.
25. *Aedes (Stegomyia) perplexus* (Leicester) A, male adult; B, aedeagus; C, male terminalia.
26. *Aedes (Stegomyia) perplexus* (Leicester) A, B, pupa; C, female terminalia.
27. *Aedes (Stegomyia) perplexus* (Leicester) A, B, C, larva.
28. *Aedes (Stegomyia) perplexus* (Leicester) A, B, C, D, female terminalia.
29. *Aedes (Stegomyia) gardnerii* (Ludlow) A, B, pupa; C, male terminalia.
30. *Aedes (Stegomyia) gardnerii* (Ludlow) A, B, C, larva.
31. *Aedes (Stegomyia) gardnerii* (Ludlow) A, B, C, D, female terminalia.

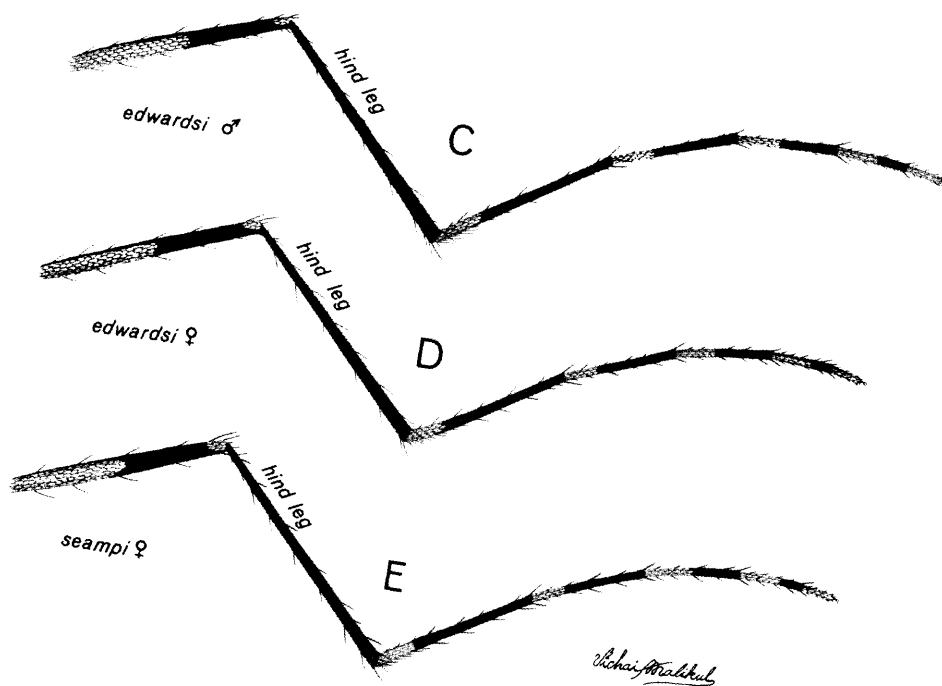
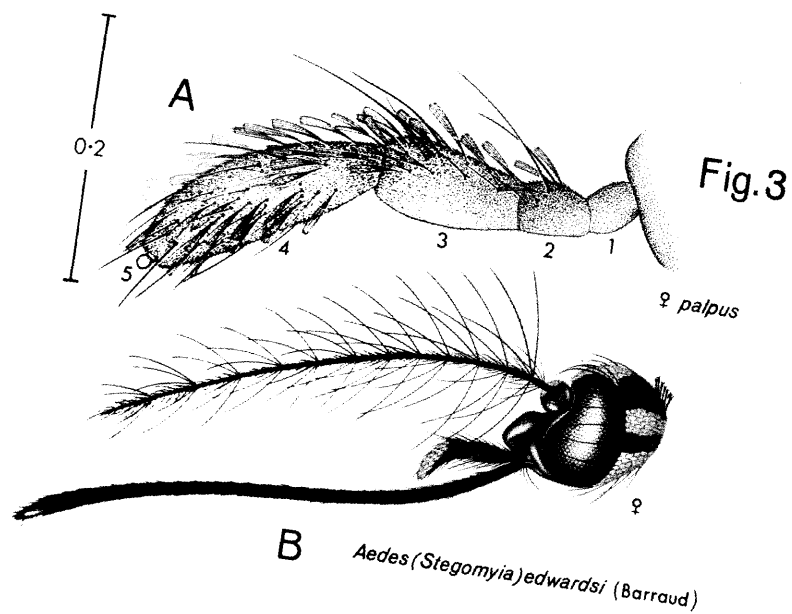
32. *Aedes (Stegomyia) gardnerii imitator* (Leicester) A, B, thorax;
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33. *Aedes (Stegomyia) w-albus* (Theobald) A, B, pupa; C, male terminalia.
34. *Aedes (Stegomyia) w-albus* (Theobald) A, B, C, larva.
35. *Aedes (Stegomyia) w-albus* (Theobald) A, B, C, D, female terminalia.

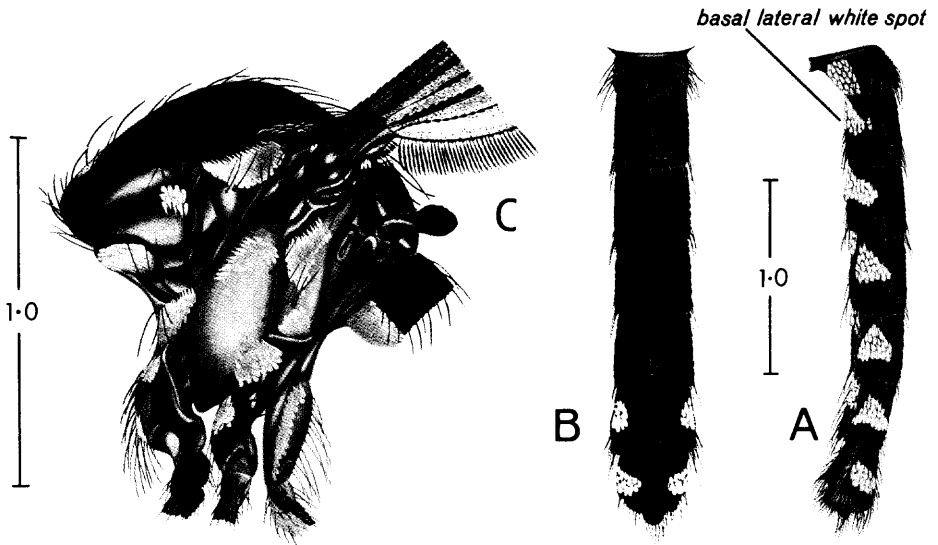


Aedes (Stegomyia) edwardsi (Barraud)



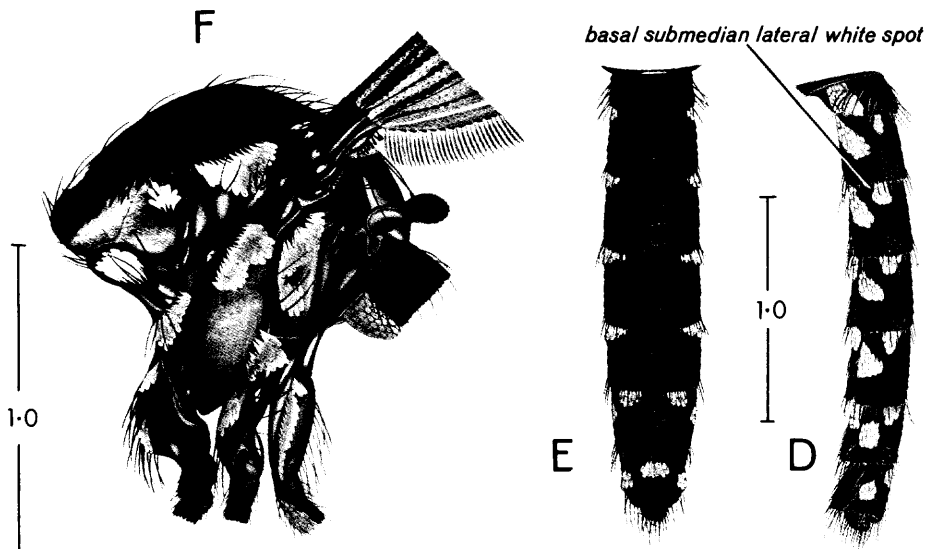
Aedes (Stegomyia) edwardsi (Barraud)





Aedes (Stegomyia) edwardsi (Barraud)

Fig.4



Aedes (Stegomyia) seampi Huang

Uchail Malikul

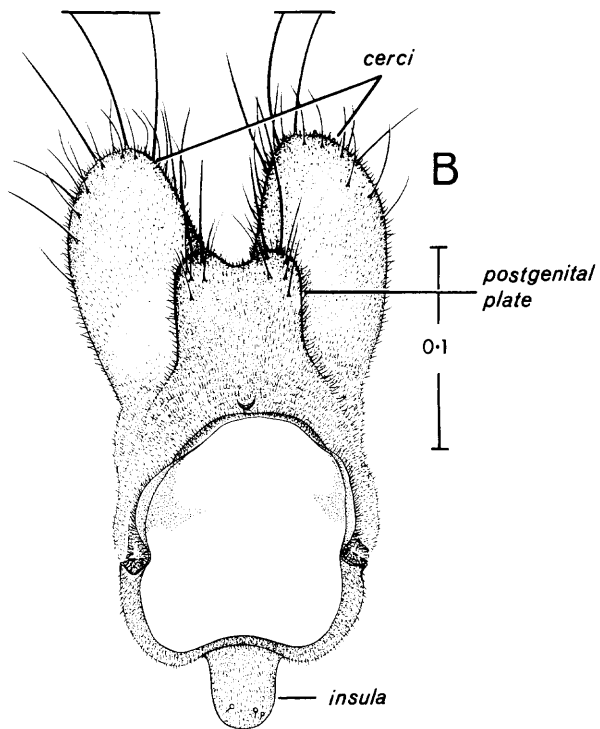
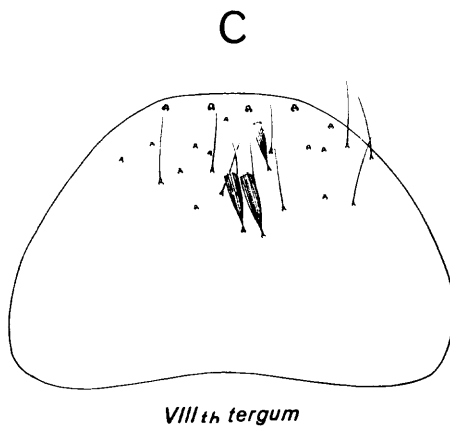
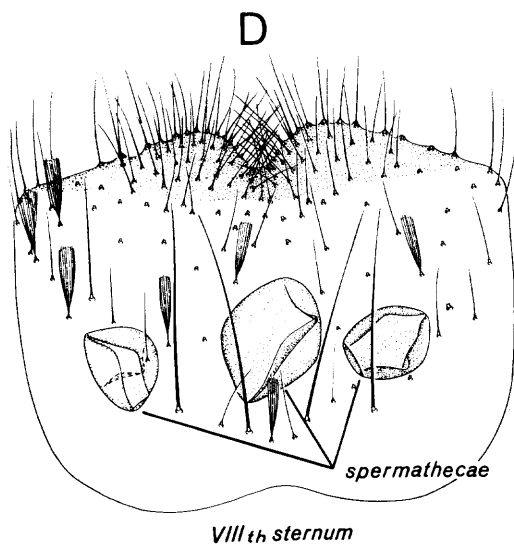
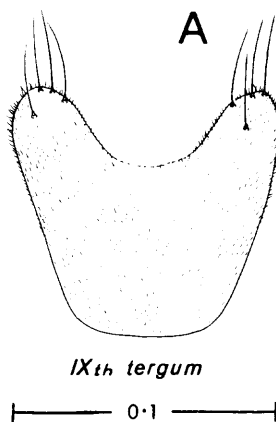


Fig. 5



Aedes (Stegomyia) seampi Huang

Vichai Matikul

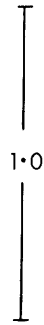
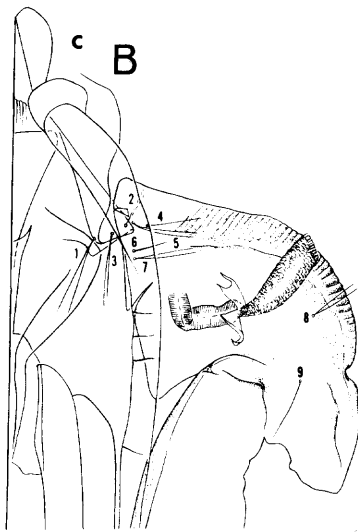
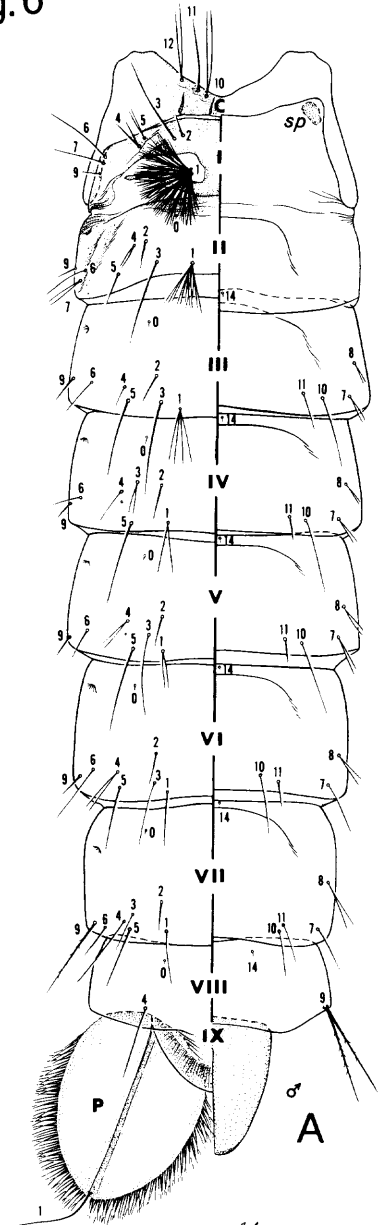
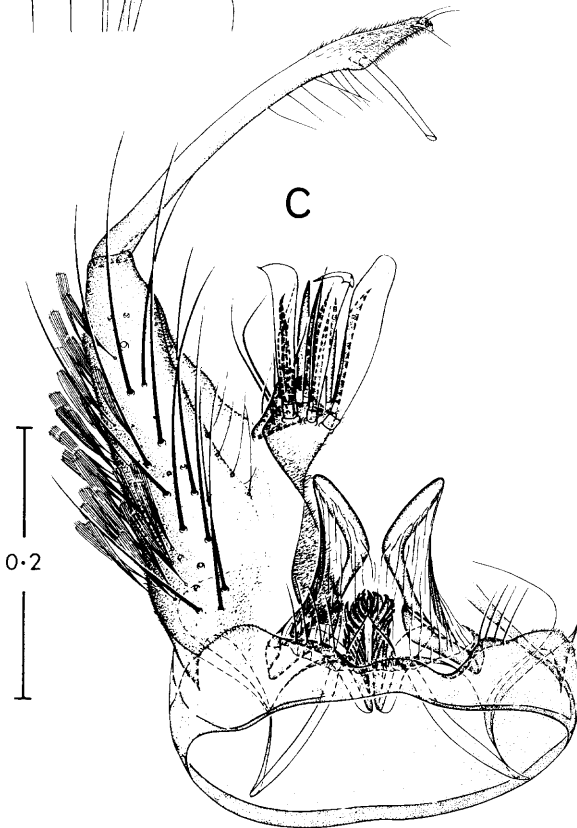


Fig.6



Chaiyachai

Aedes (Stegomyia) annandalei (Theobald)

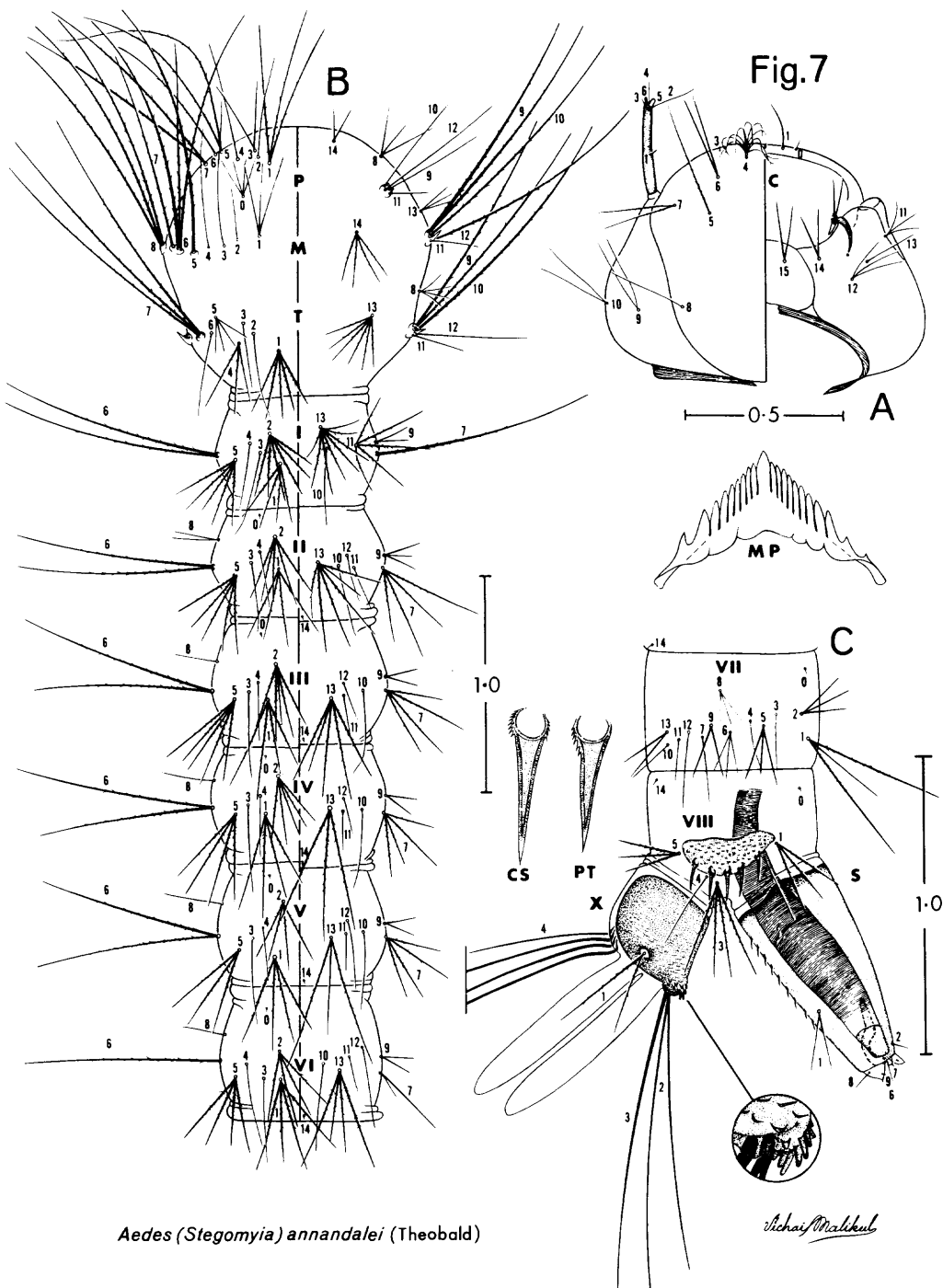
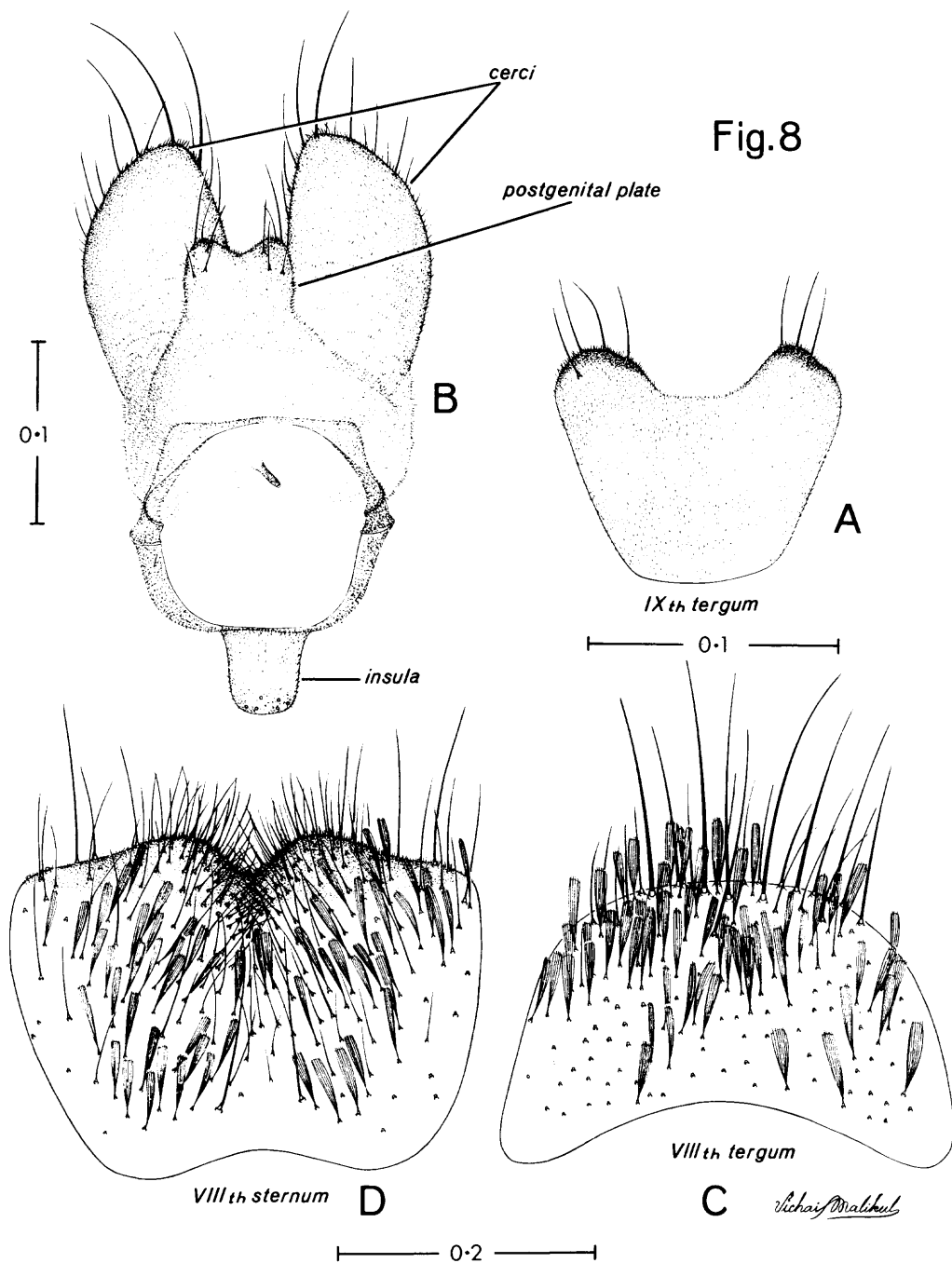
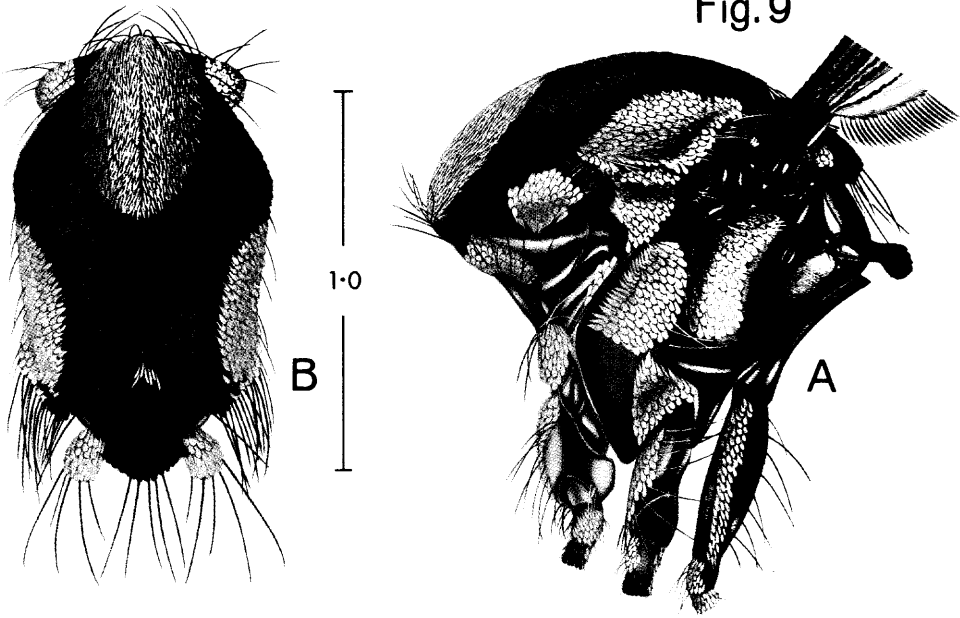


Fig.8

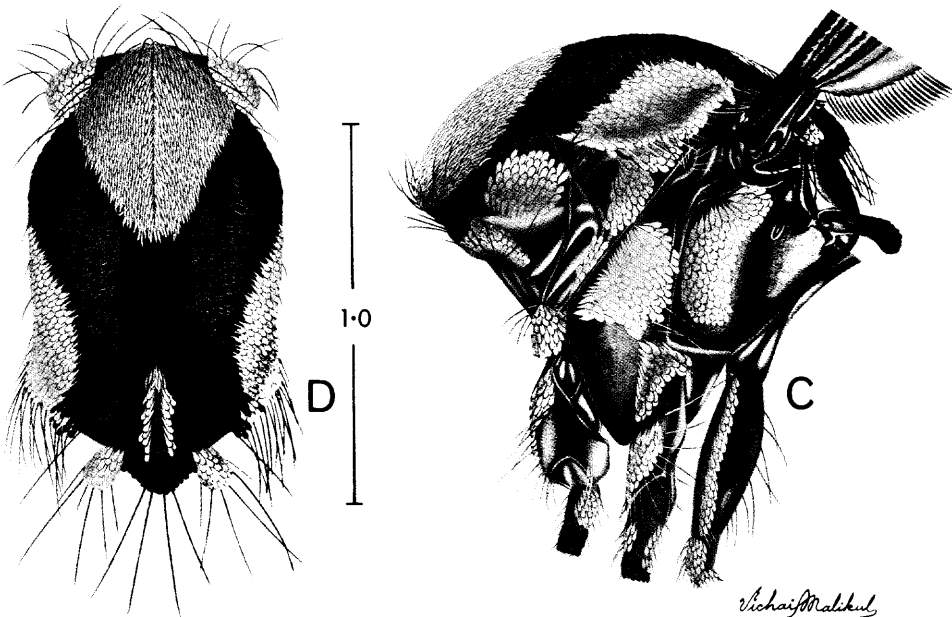


Aedes (Stegomyia) annandalei (Theobald)

Fig. 9



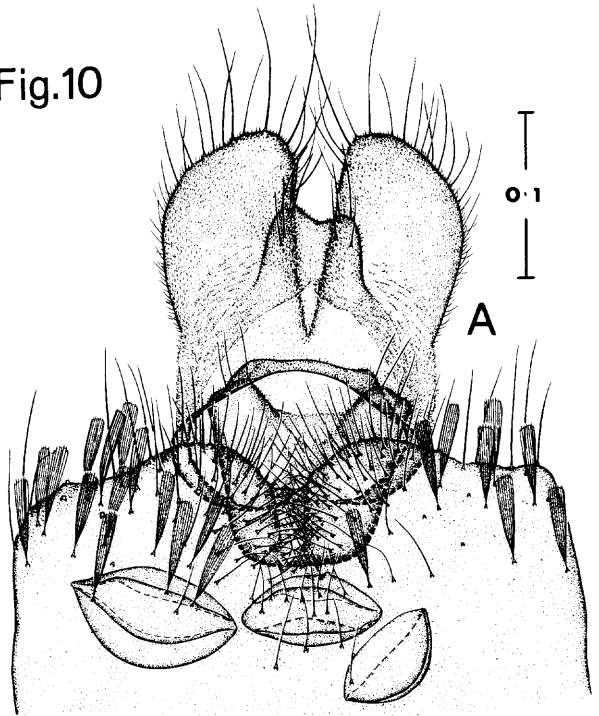
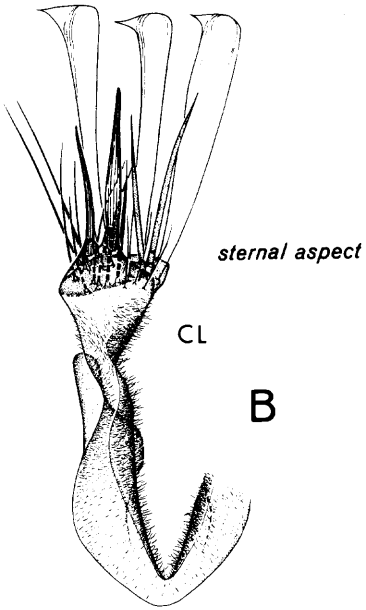
Aedes (Stegomyia) annandalei (Theobald)



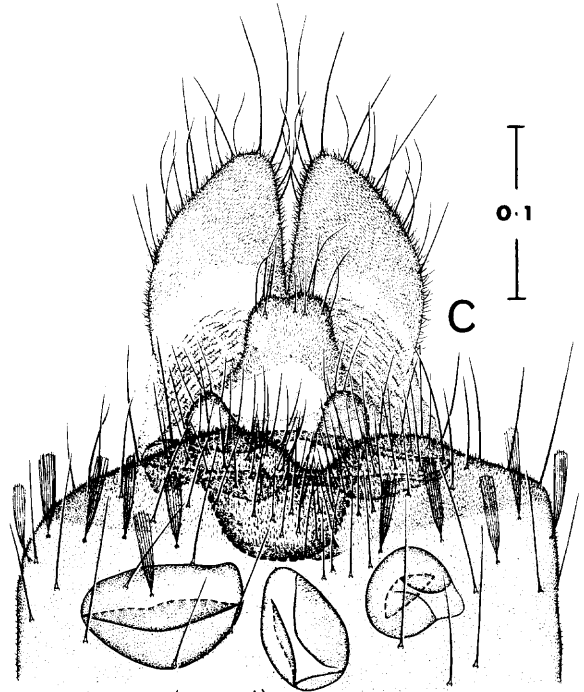
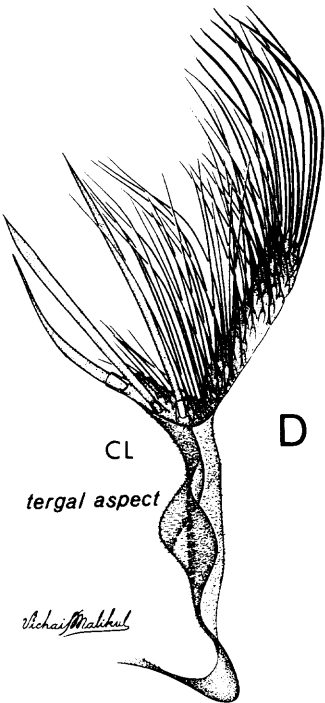
Aedes (Stegomyia) craggi (Barraud)

Vichai Malikul

Fig.10



Aedes (Stegomyia) annandalei (Theobald)



Aedes (Stegomyia) craggi (Barraud)

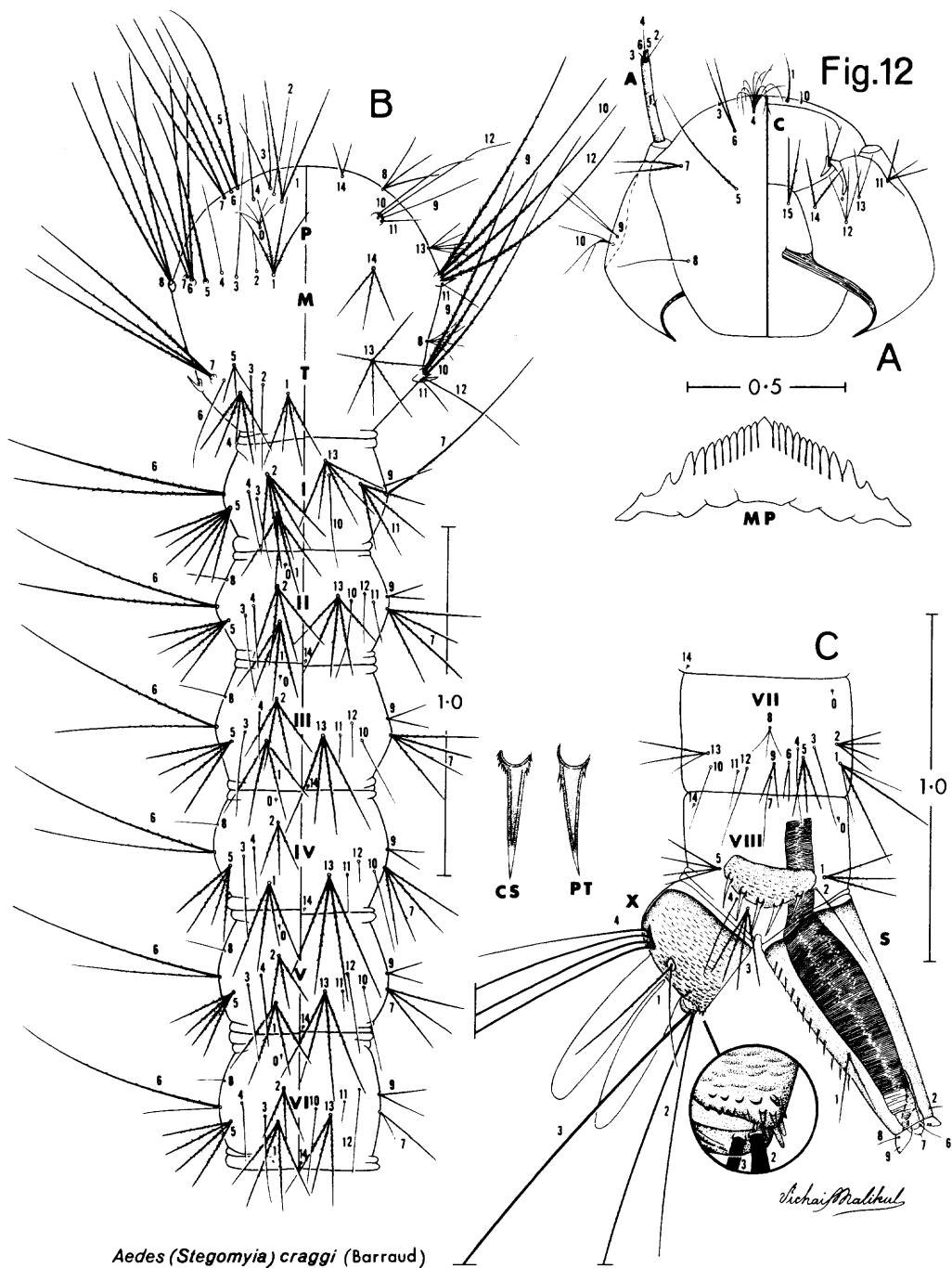
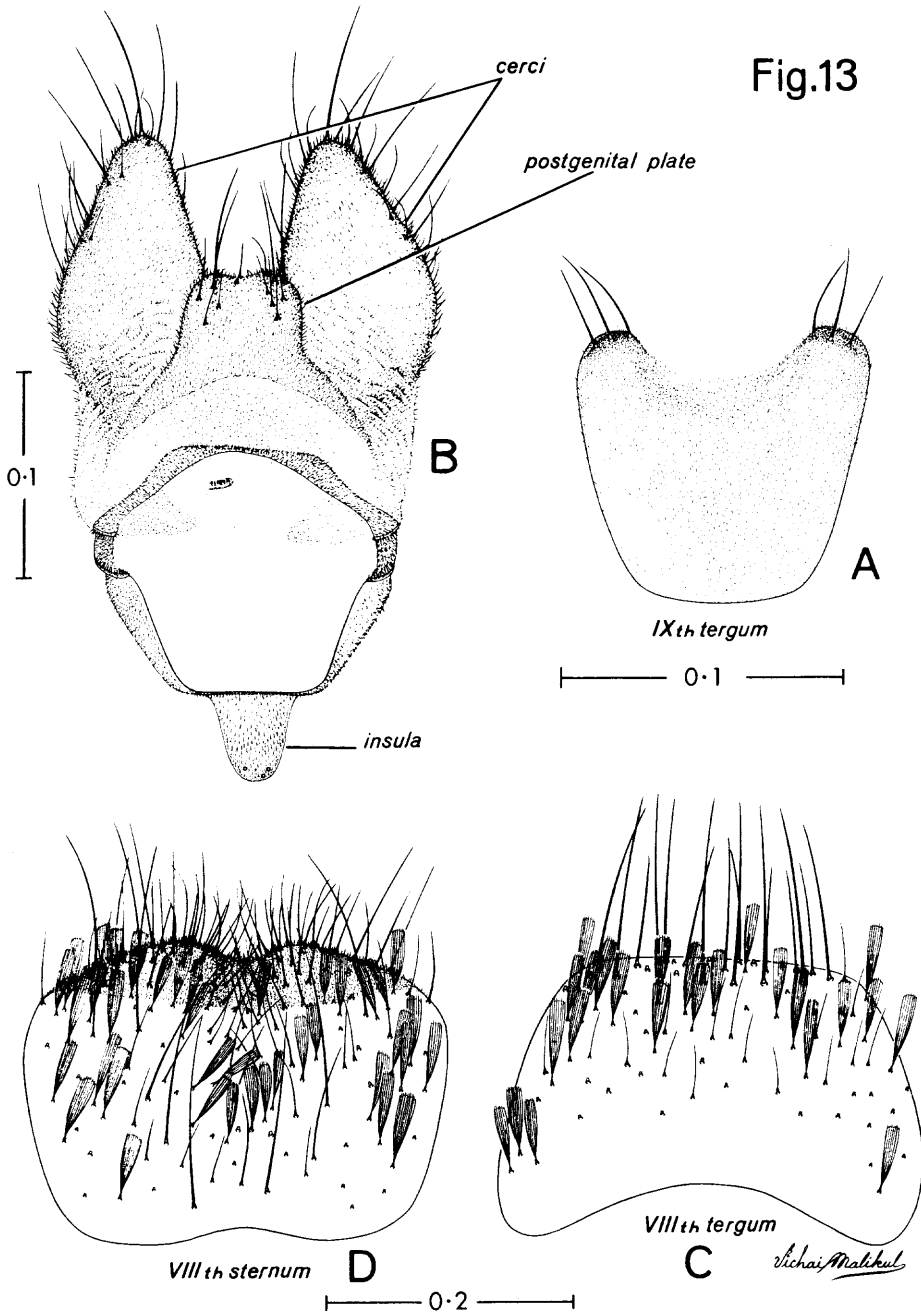
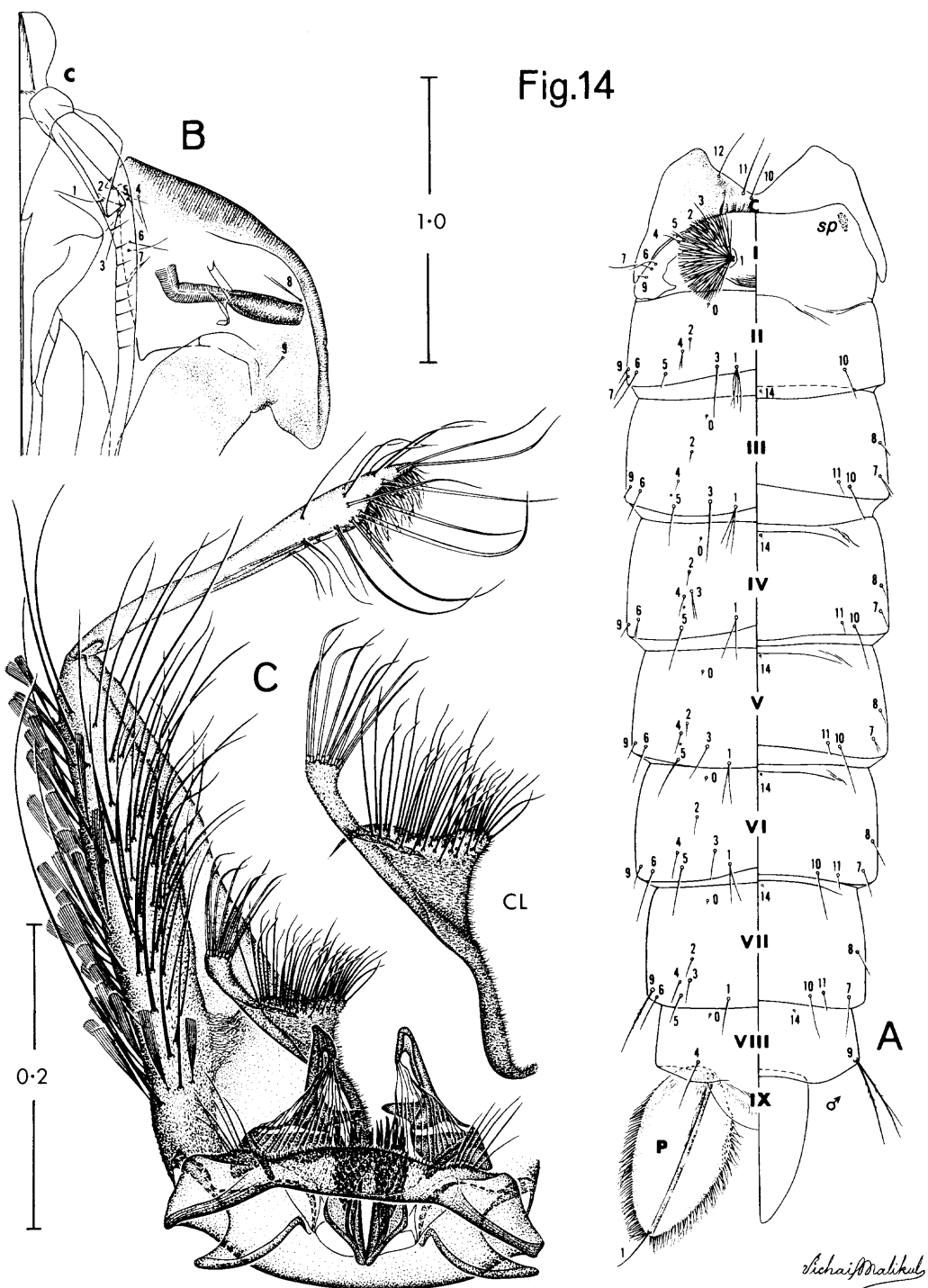


Fig.13

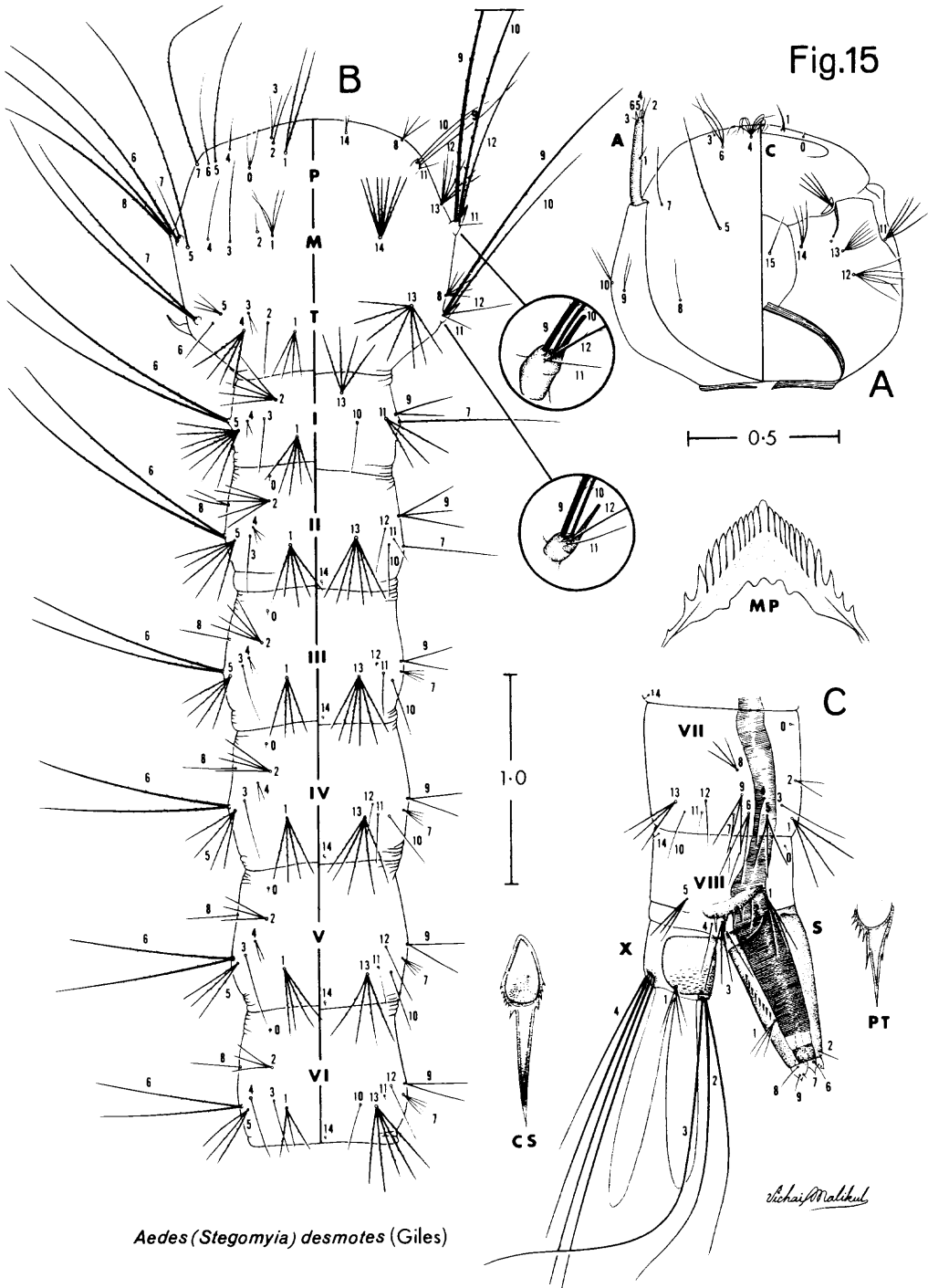


Aedes (Stegomyia) craggi (Barraud)



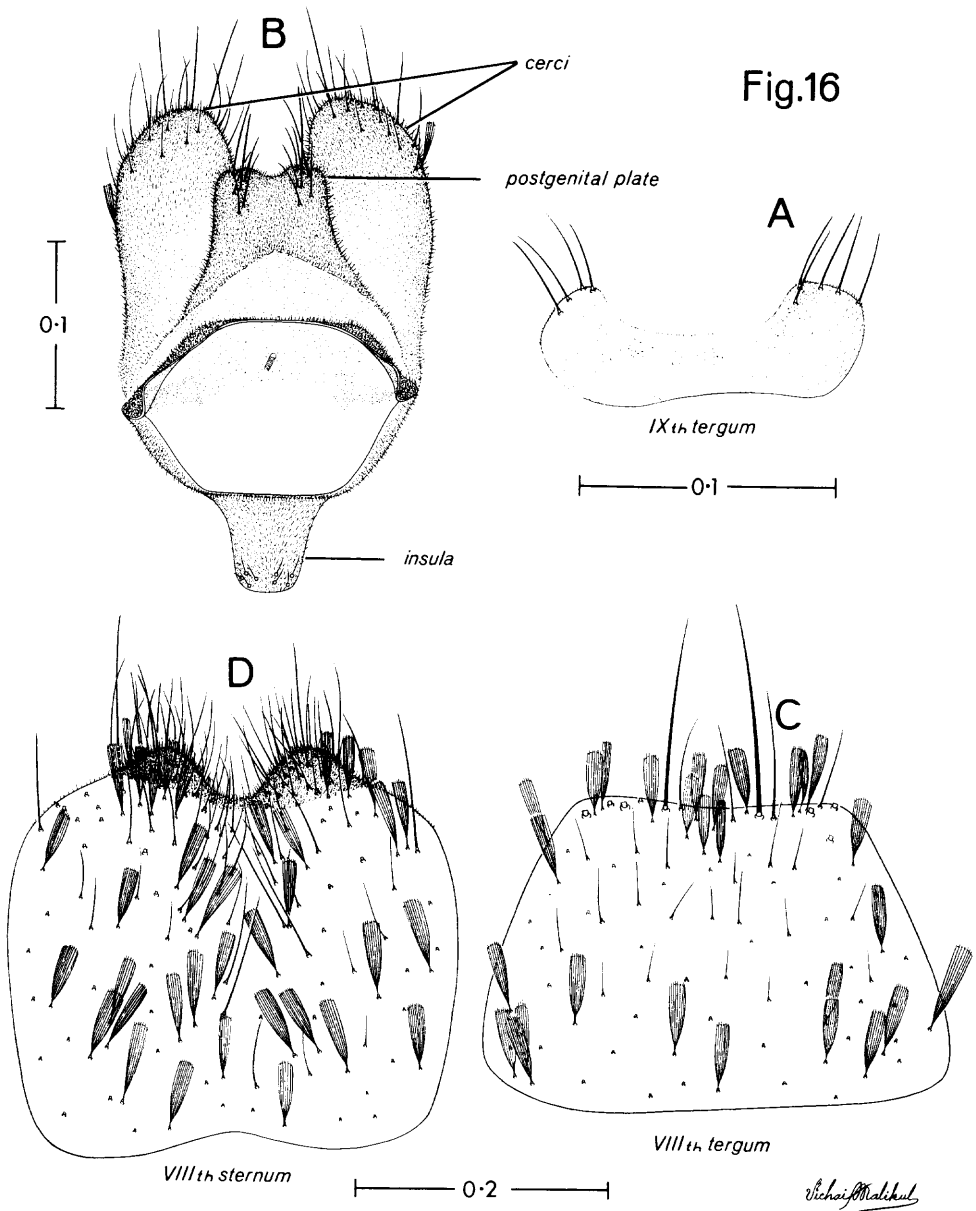
Aedes (Stegomyia) desmotes (Giles)

Fig.15



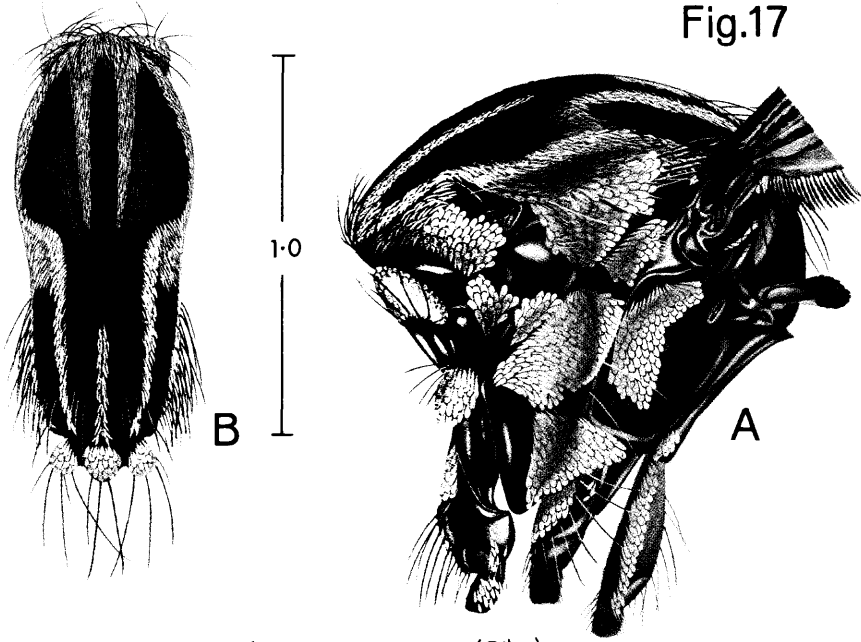
Aedes (Stegomyia) desmotes (Giles)

Fig.16

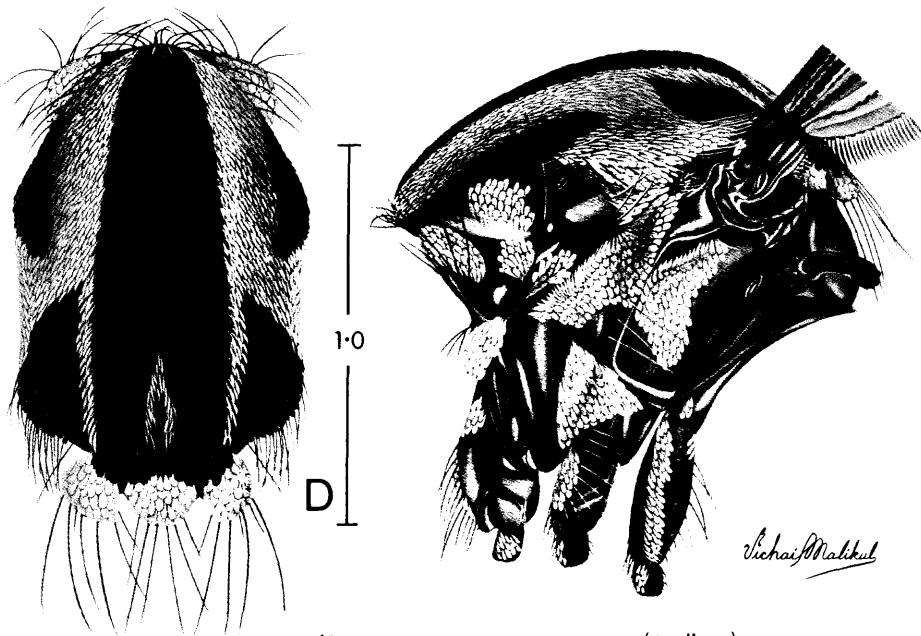


Aedes (Stegomyia) desmotes (Giles)

Fig.17

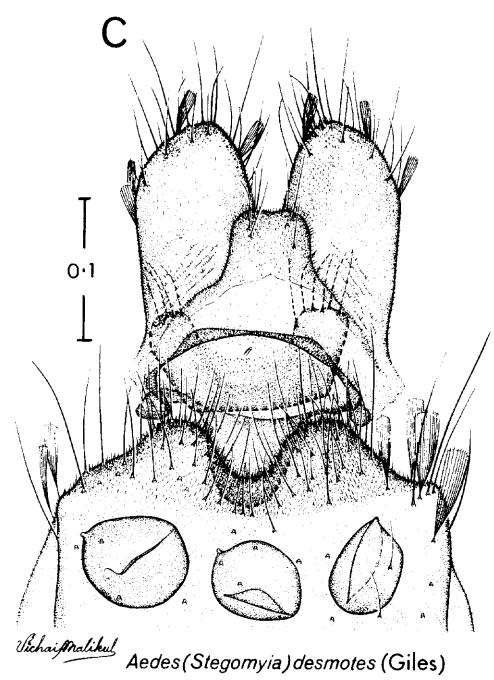
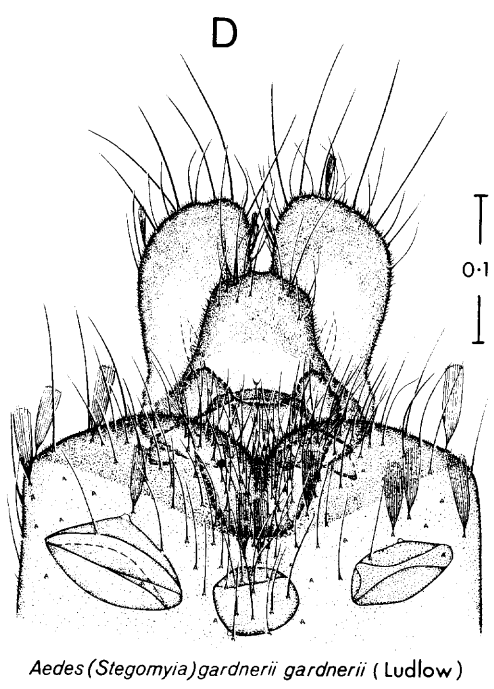
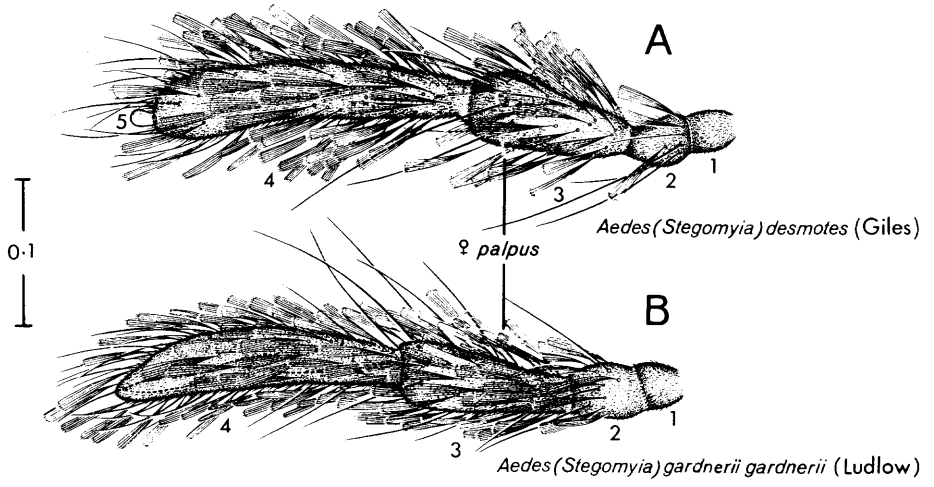


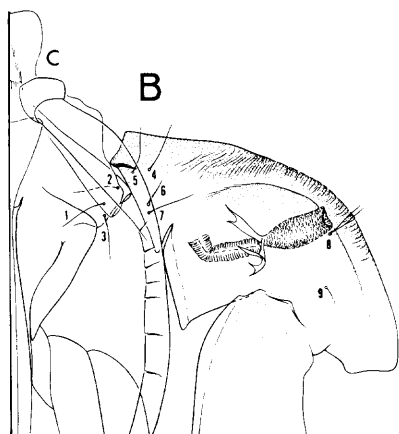
Aedes (Stegomyia) desmotes (Giles)



Aedes (Stegomyia) gardnerii gardnerii (Ludlow)

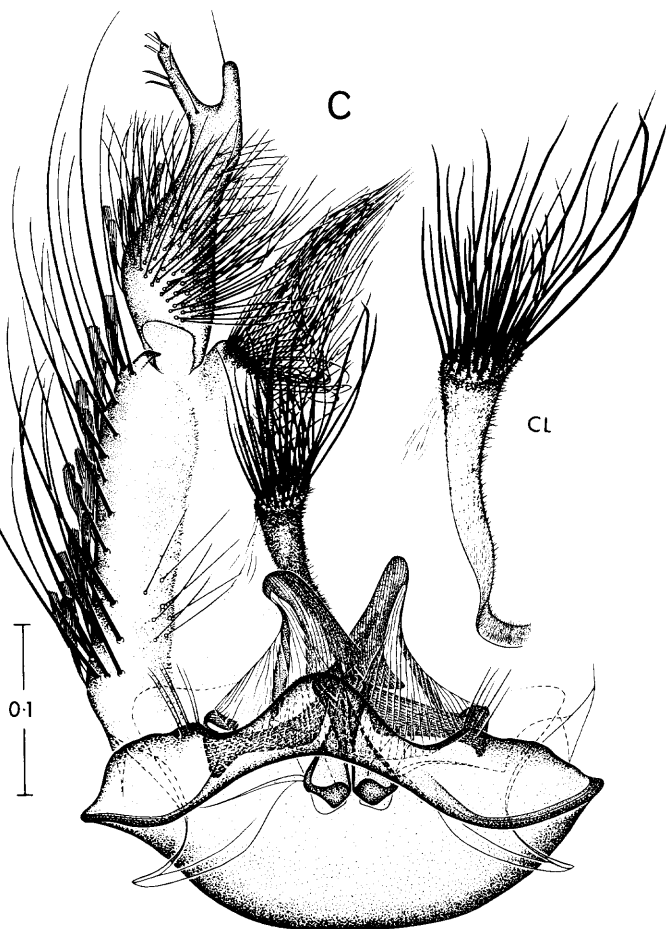
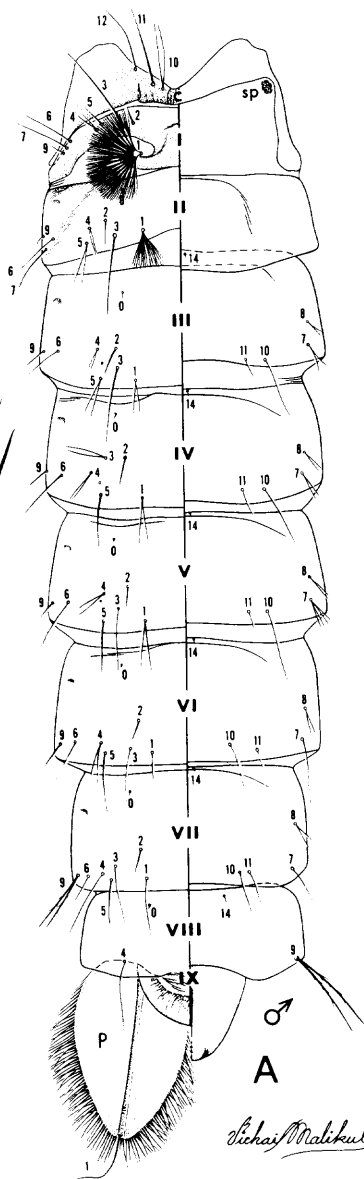
Fig.18





1.0

Fig.19



Aedes (Stegomyia) malikuli Huang

Sichai Malikul

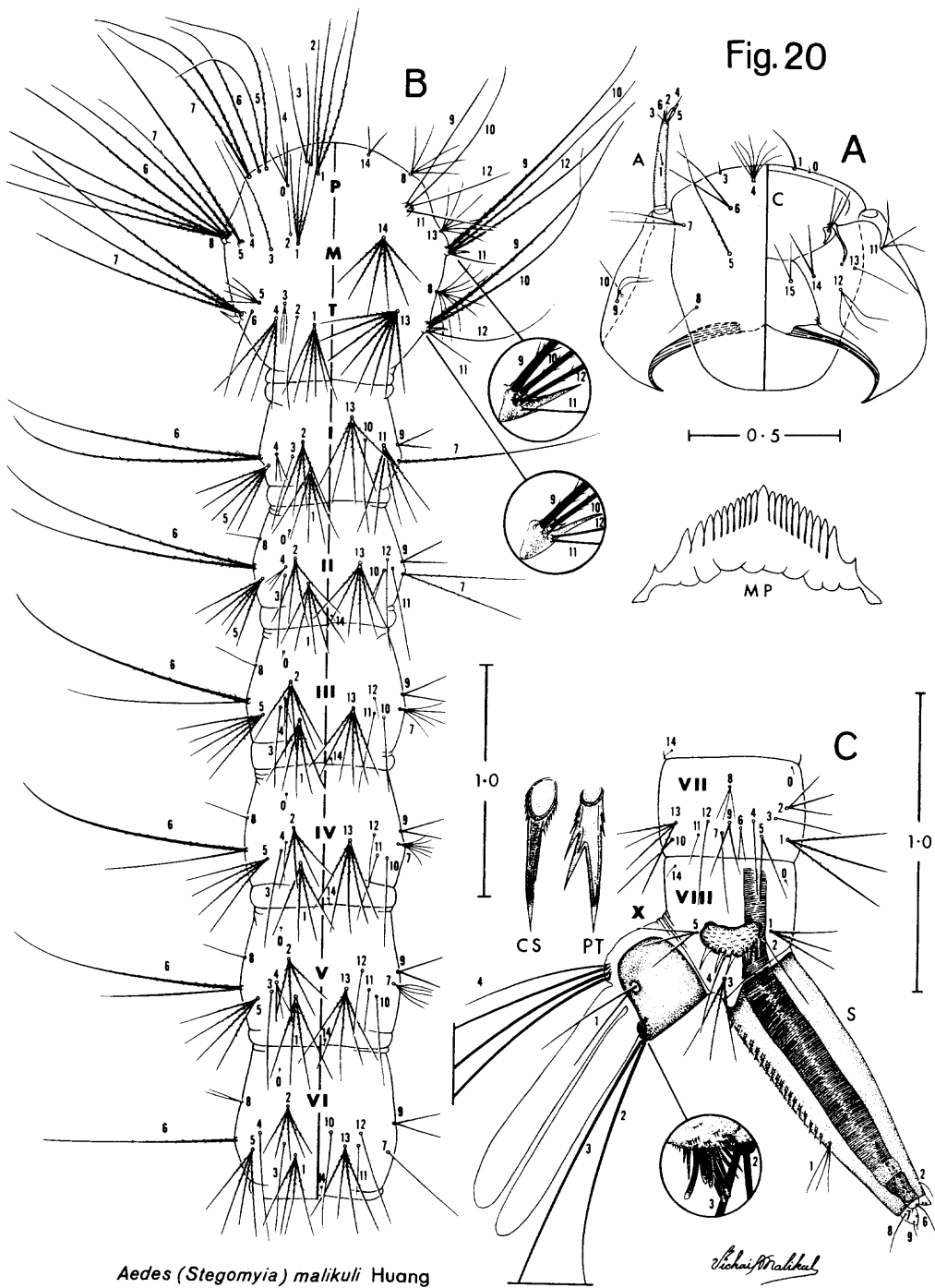


Fig.21

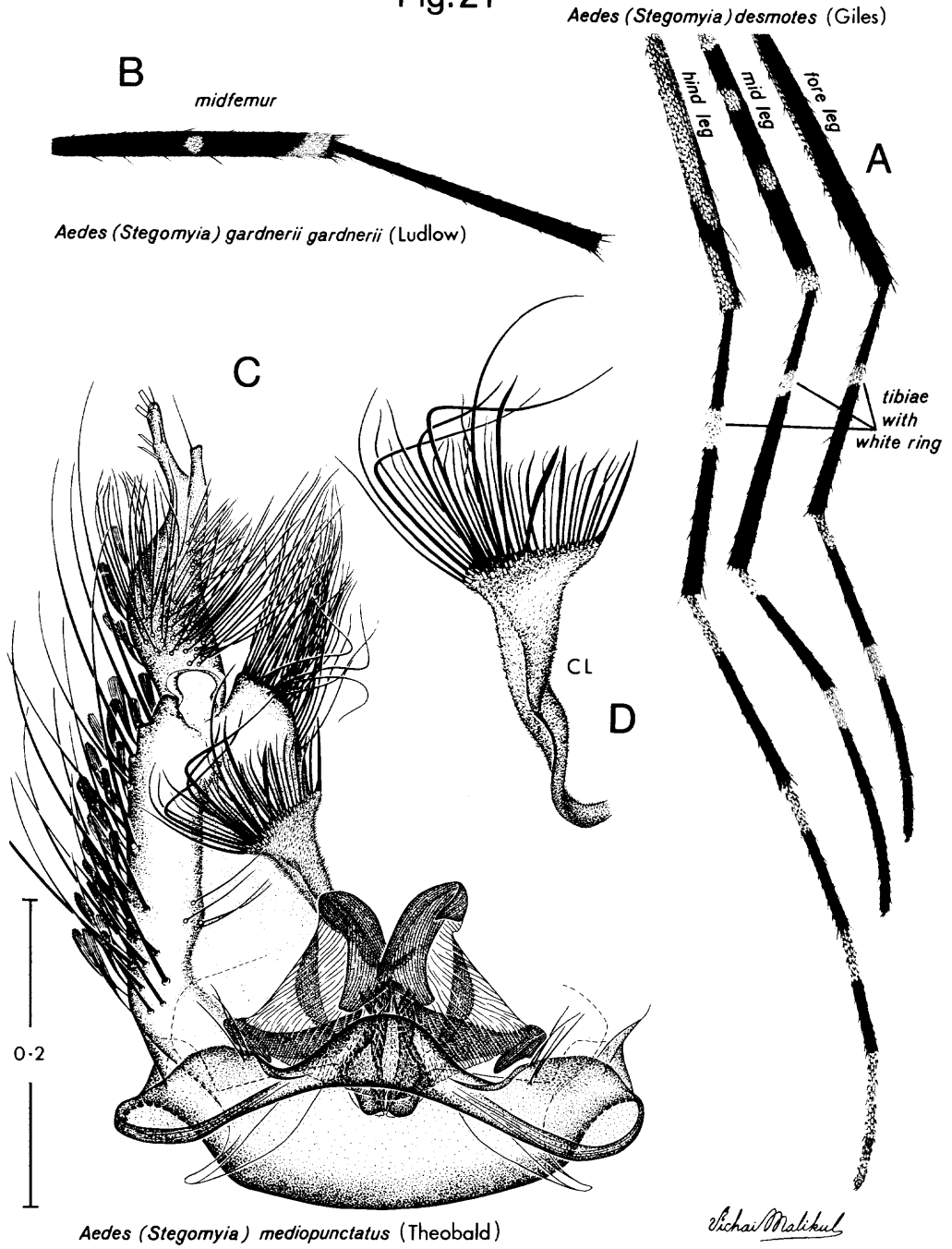
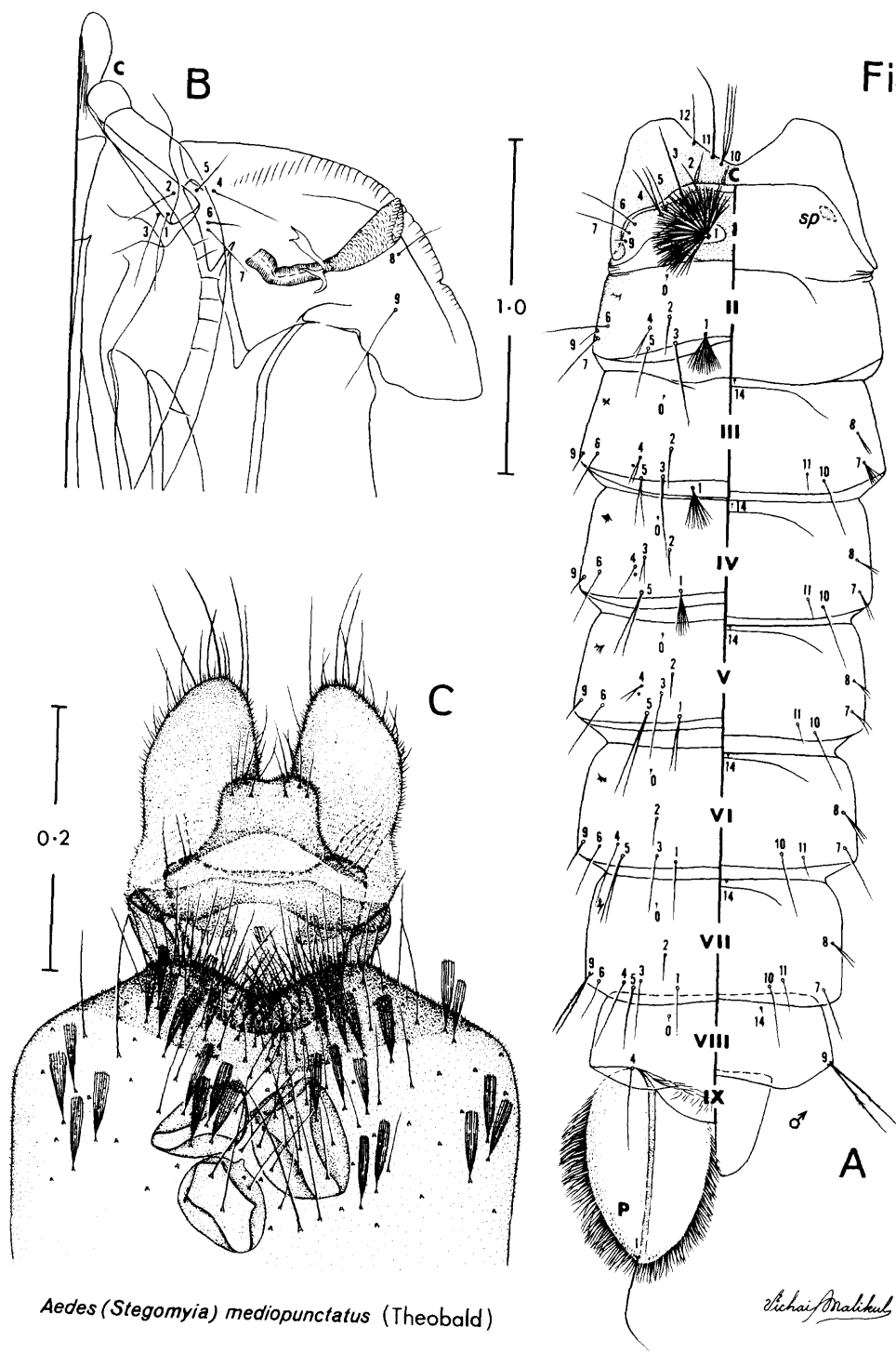
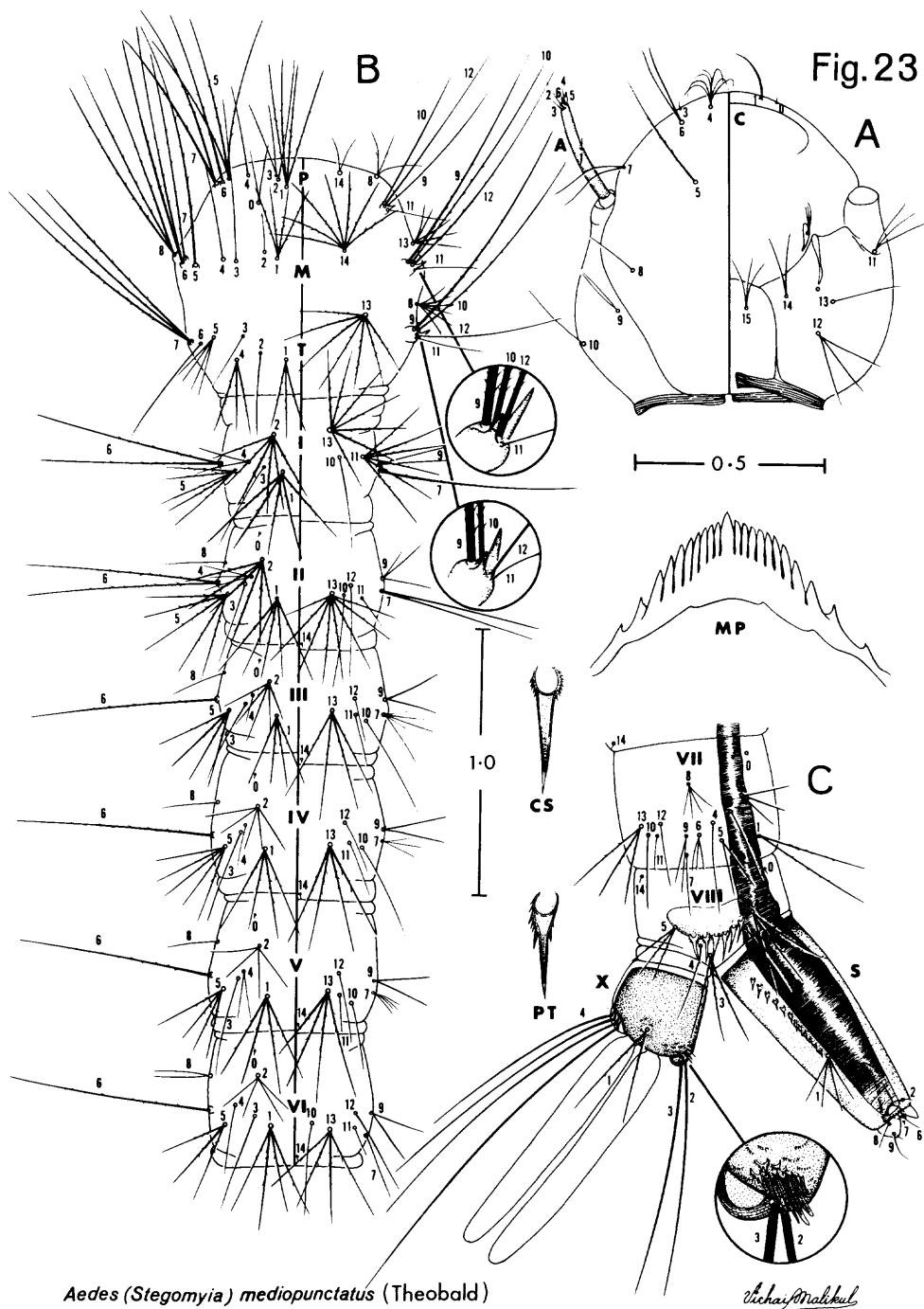
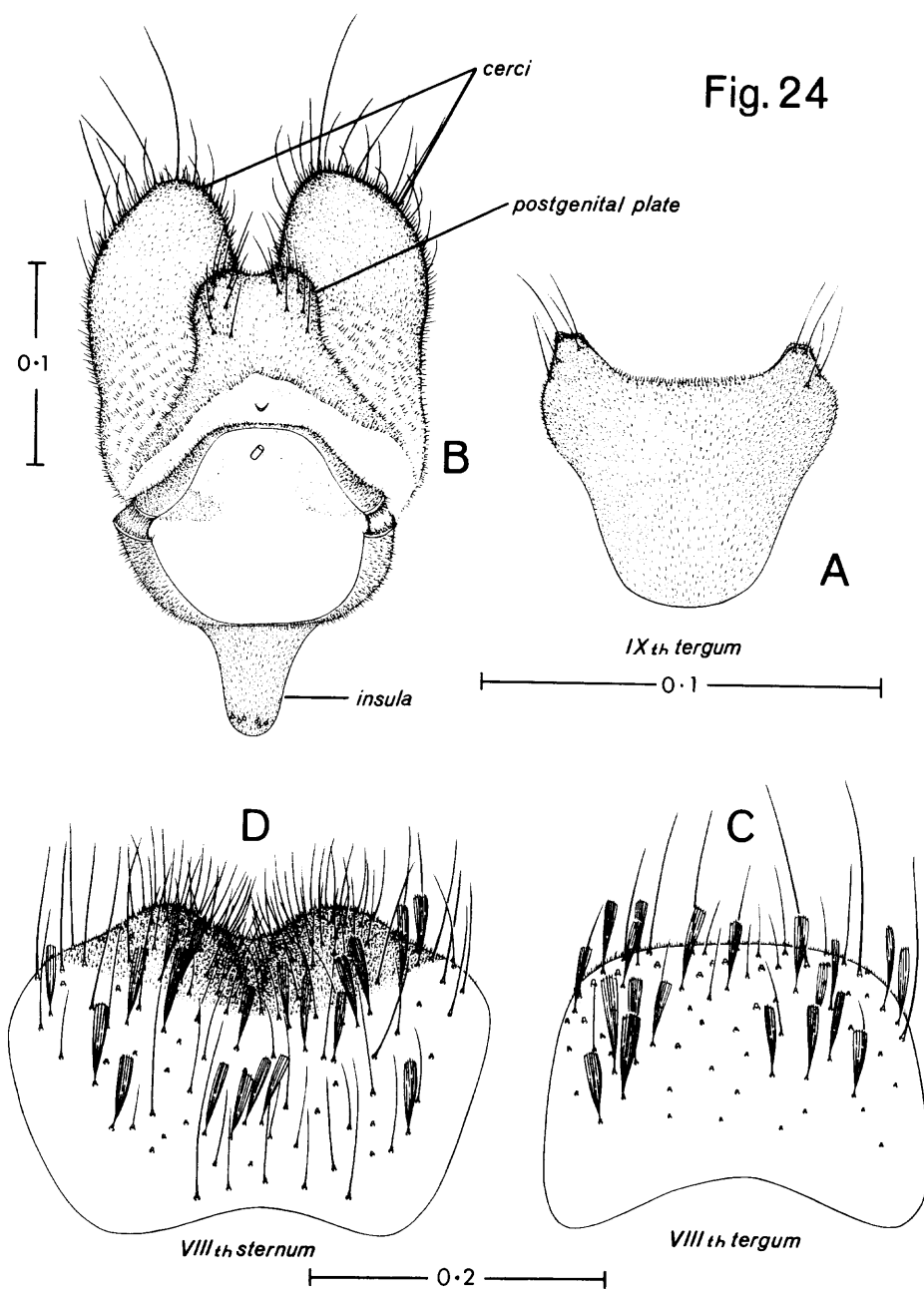


Fig.22



Aedes (Stegomyia) mediopunctatus (Theobald)

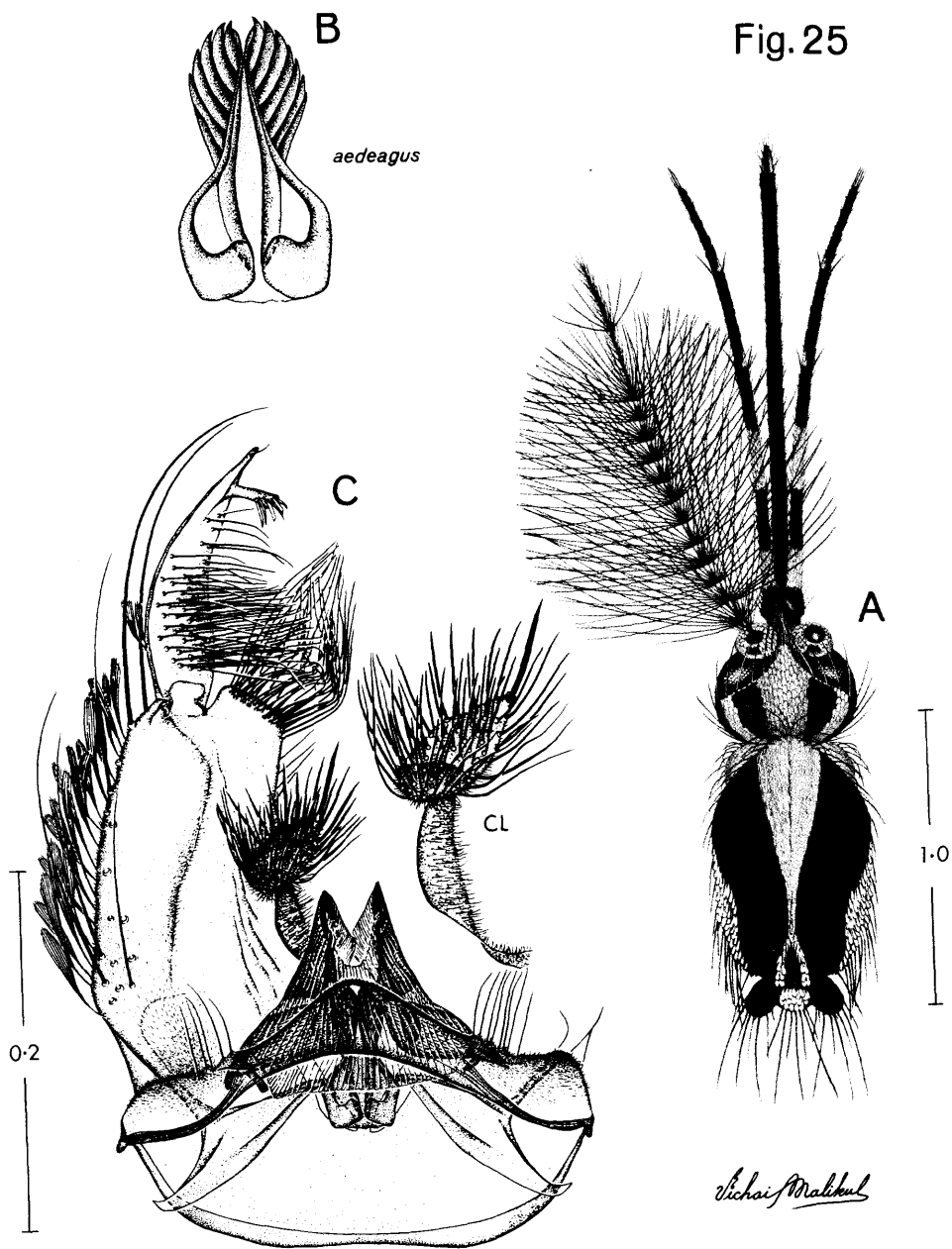




Aedes (Stegomyia) mediopunctatus (Theobald)

Richard Malick

Fig. 25



Aedes (Stegomyia) perplexus (Leicester)

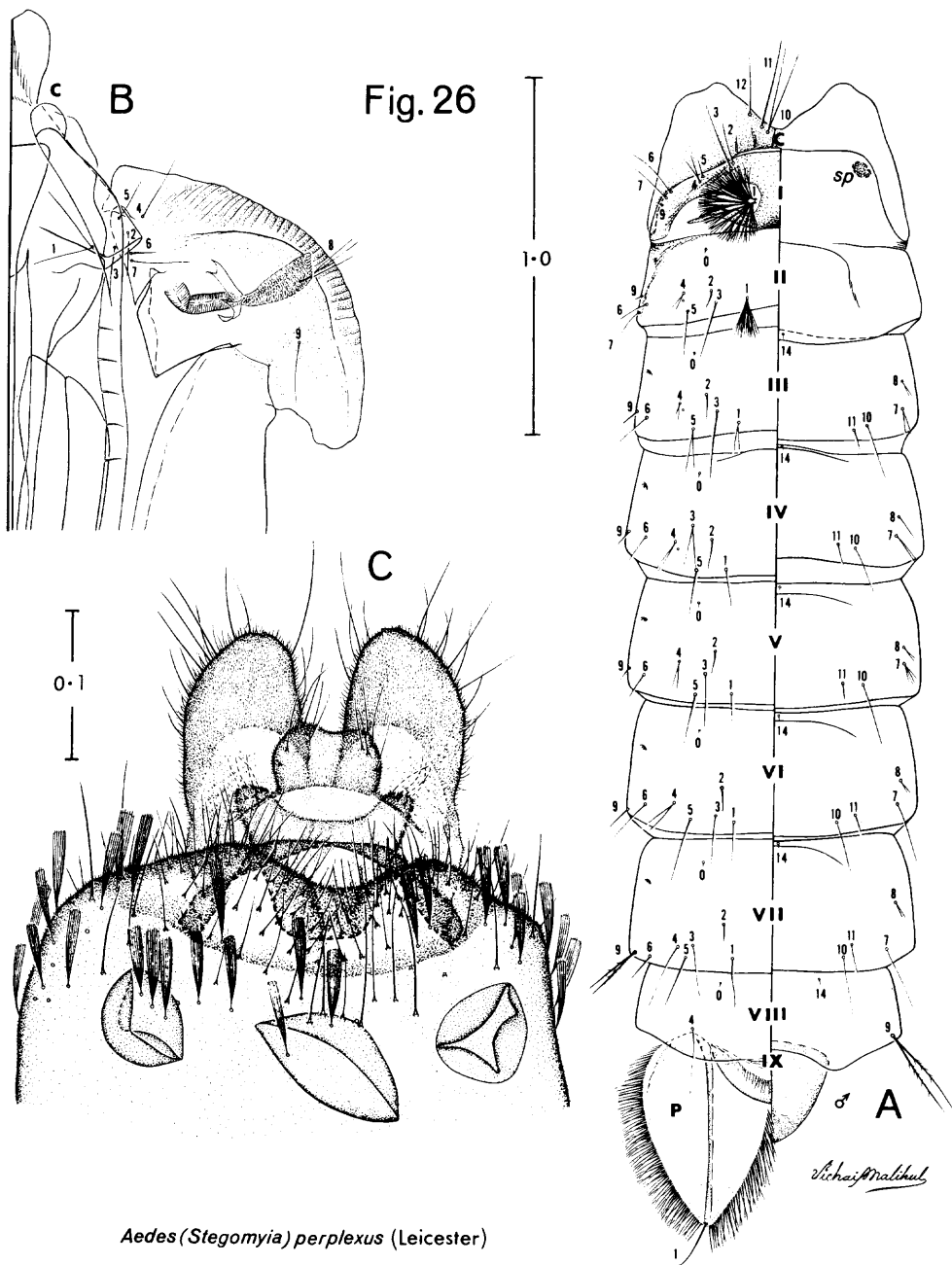
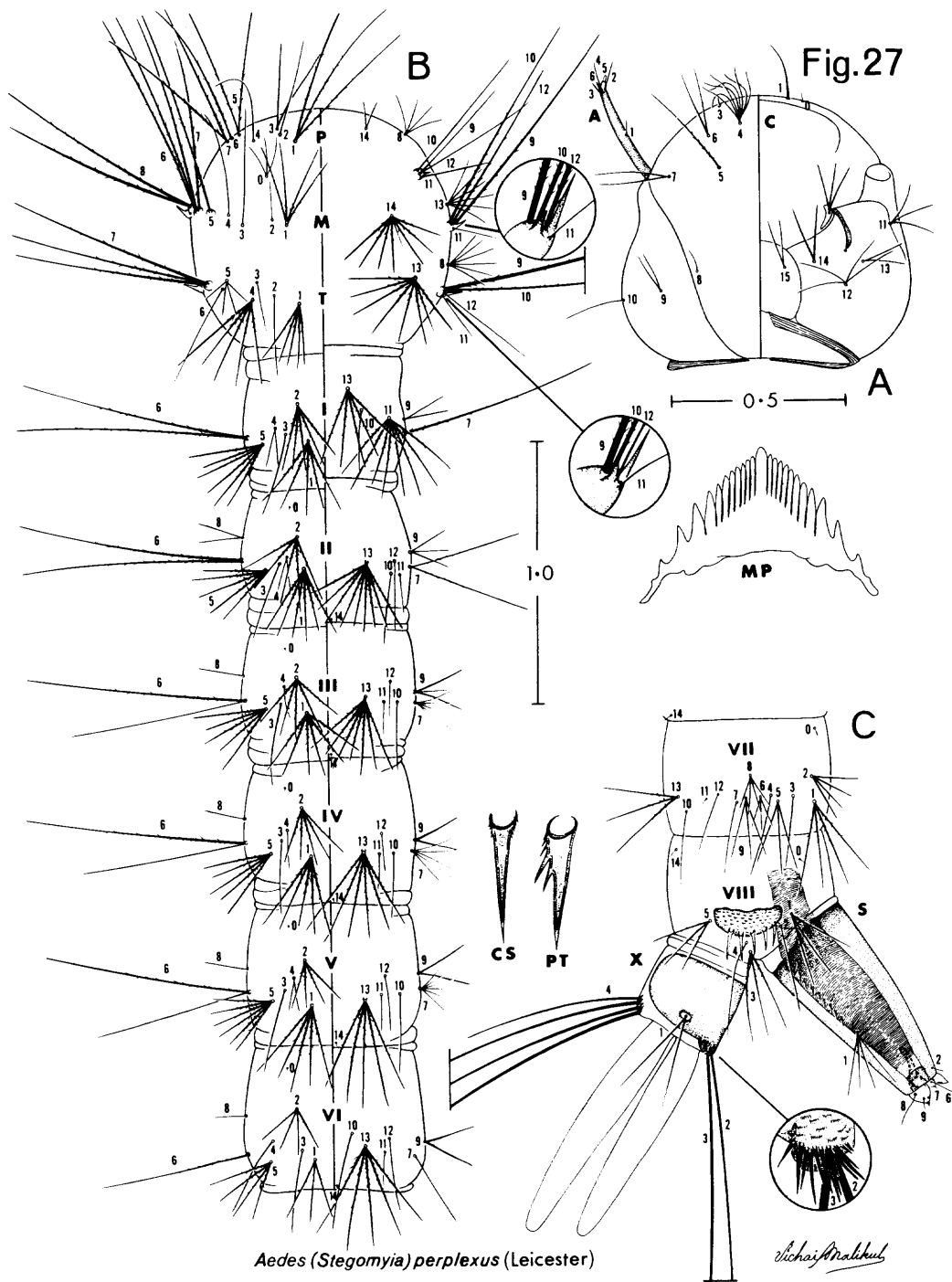
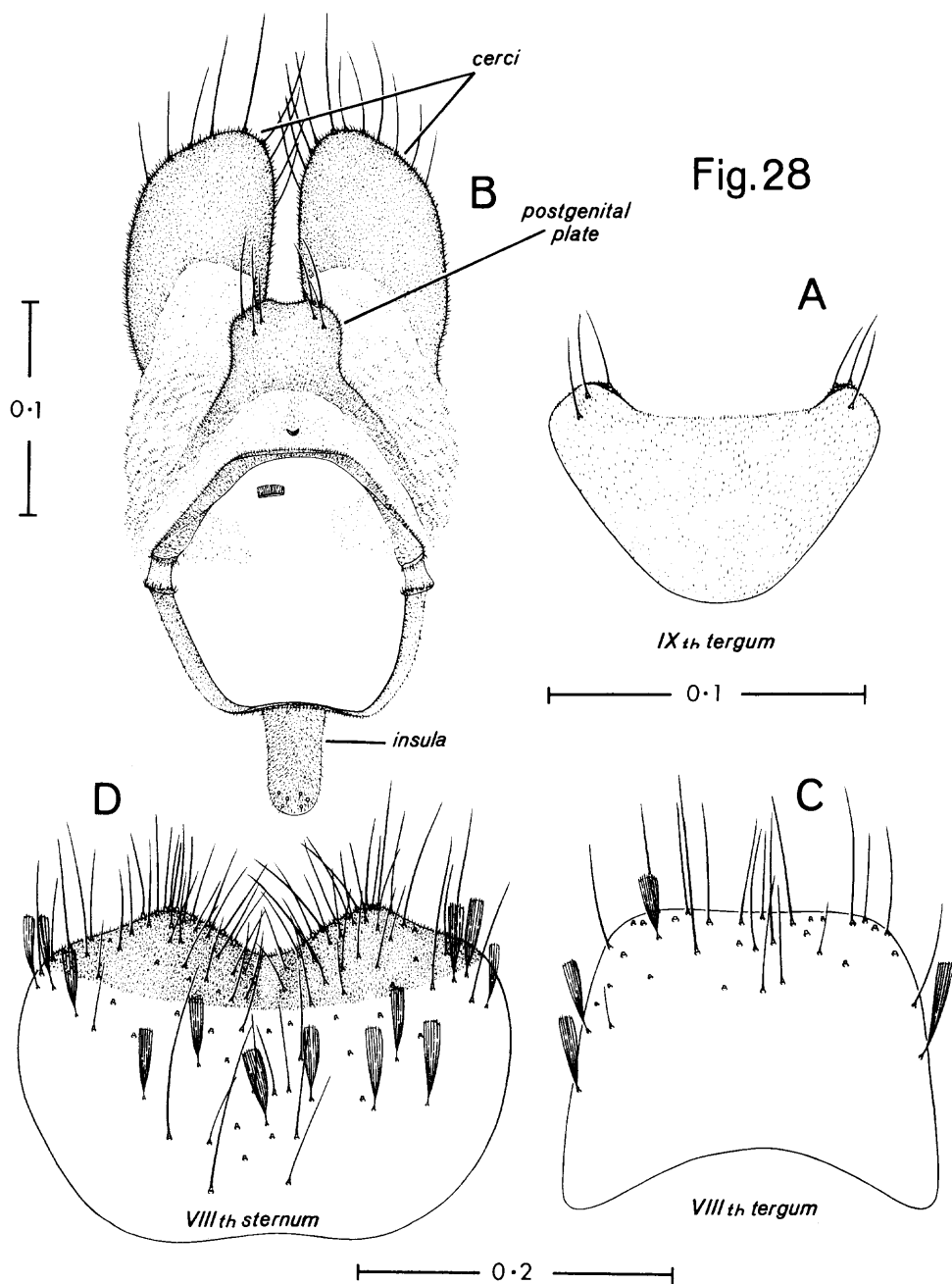


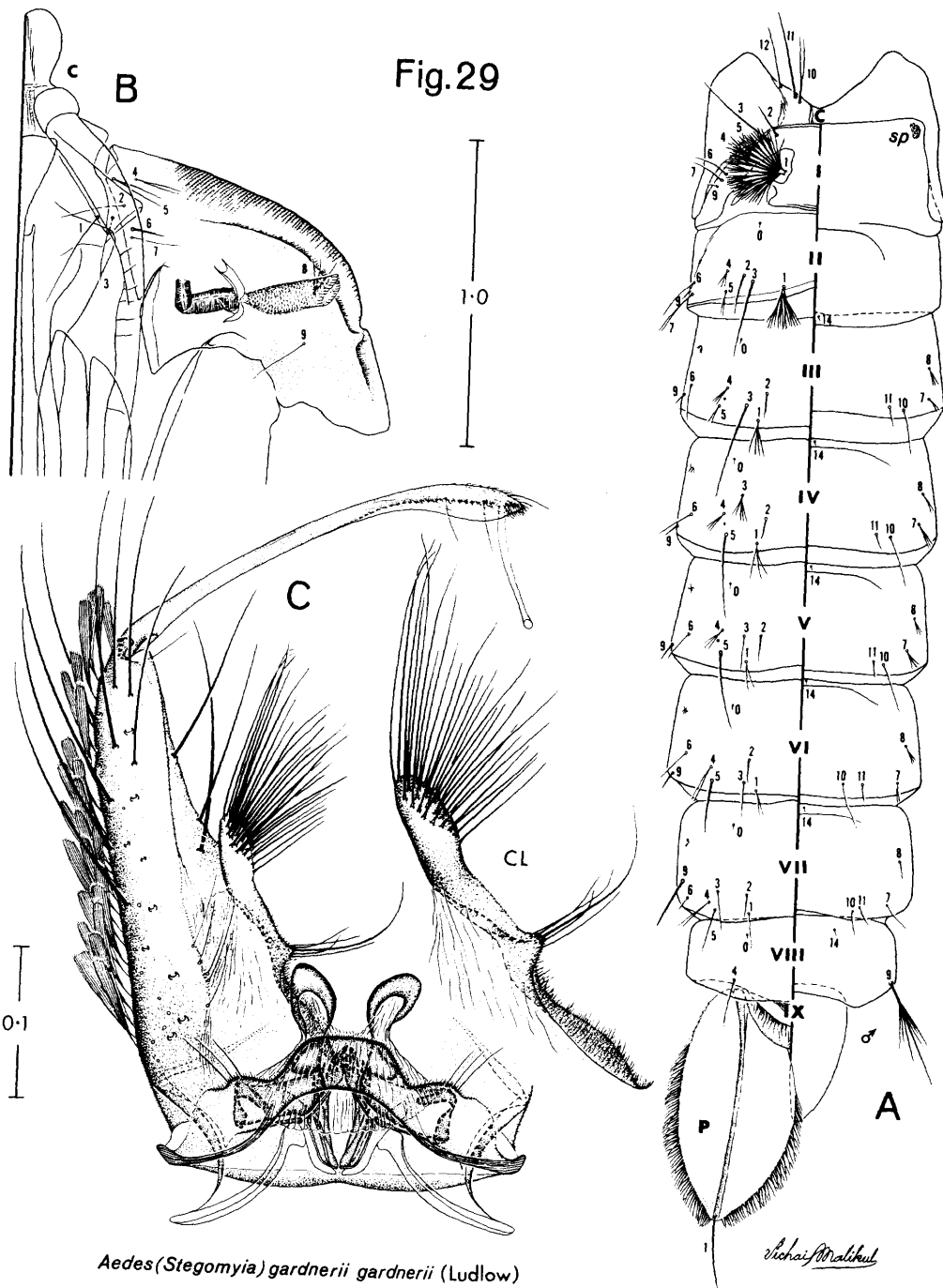
Fig.27

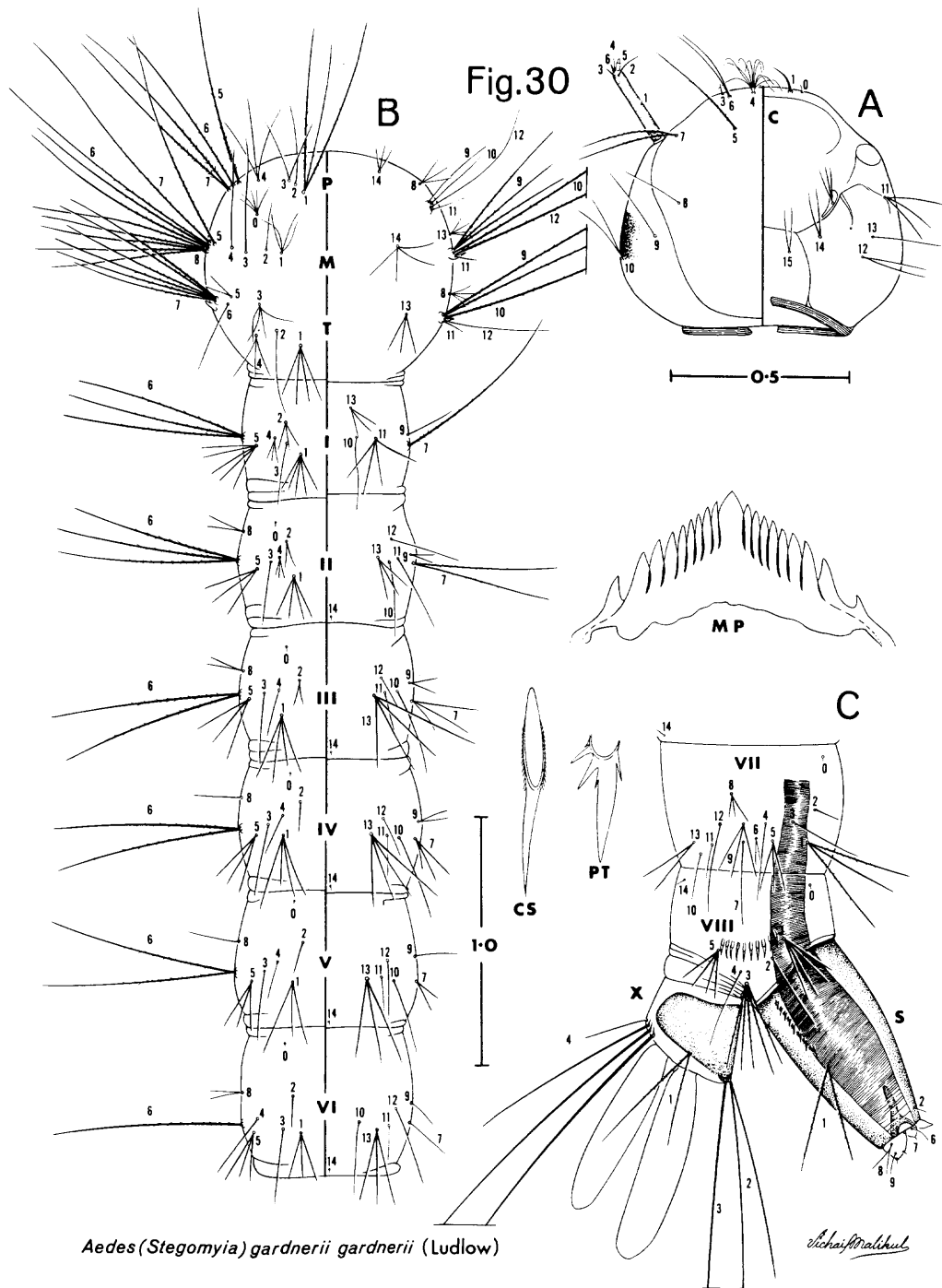




Aedes (Stegomyia) perplexus (Leicester)

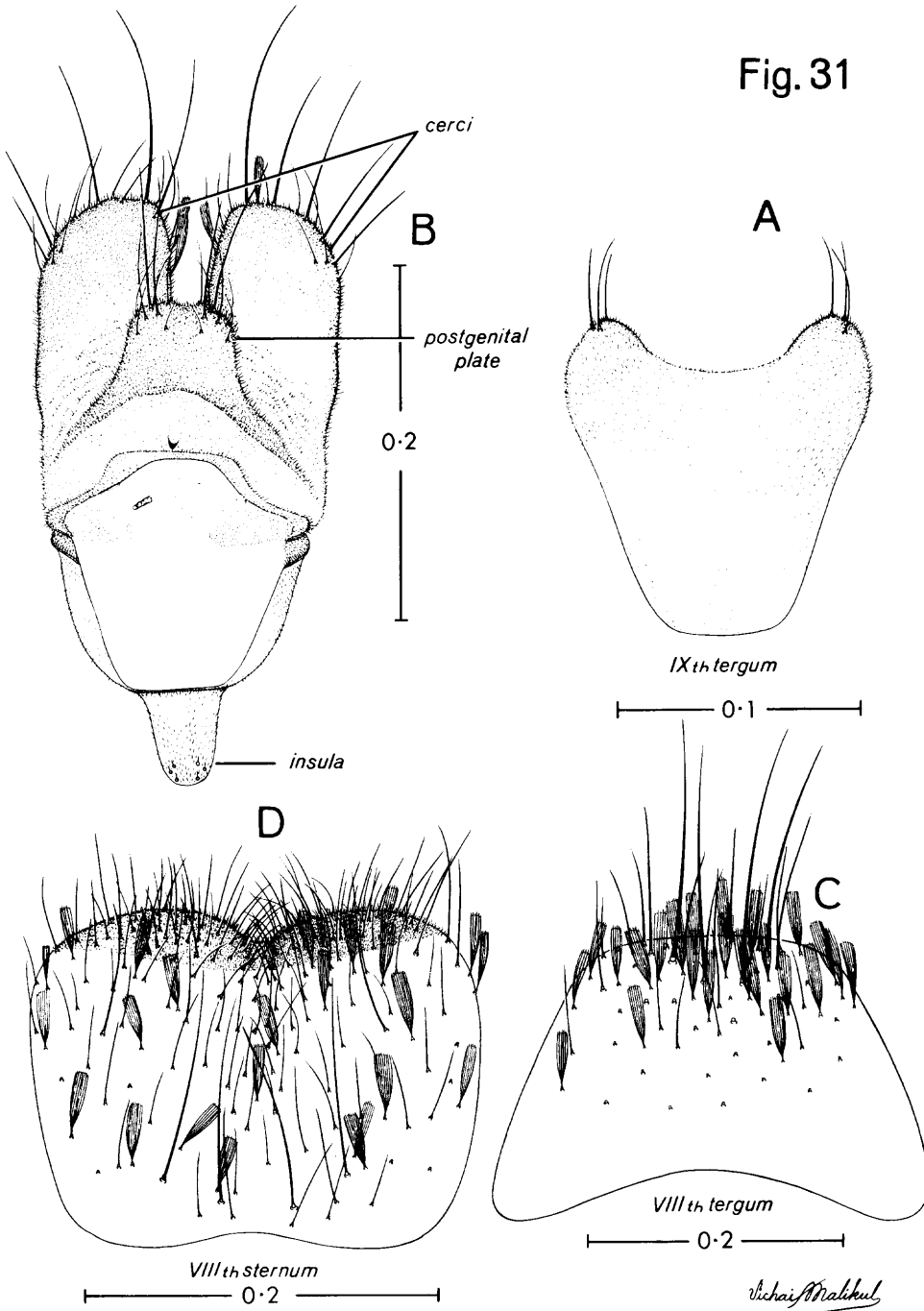
Richard Mahesh





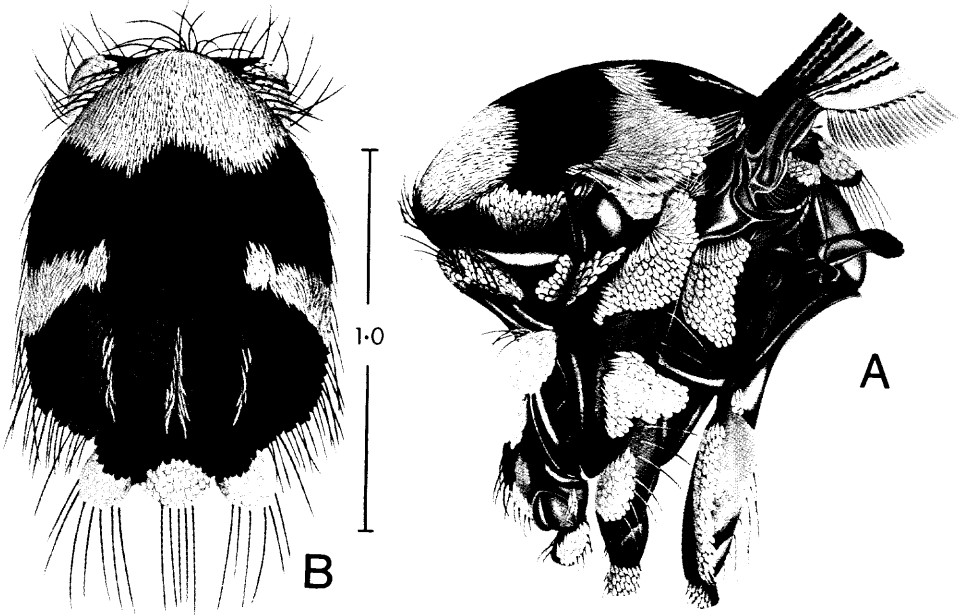
Aedes (Stegomyia) gardnerii gardnerii (Ludlow)

Fig. 31

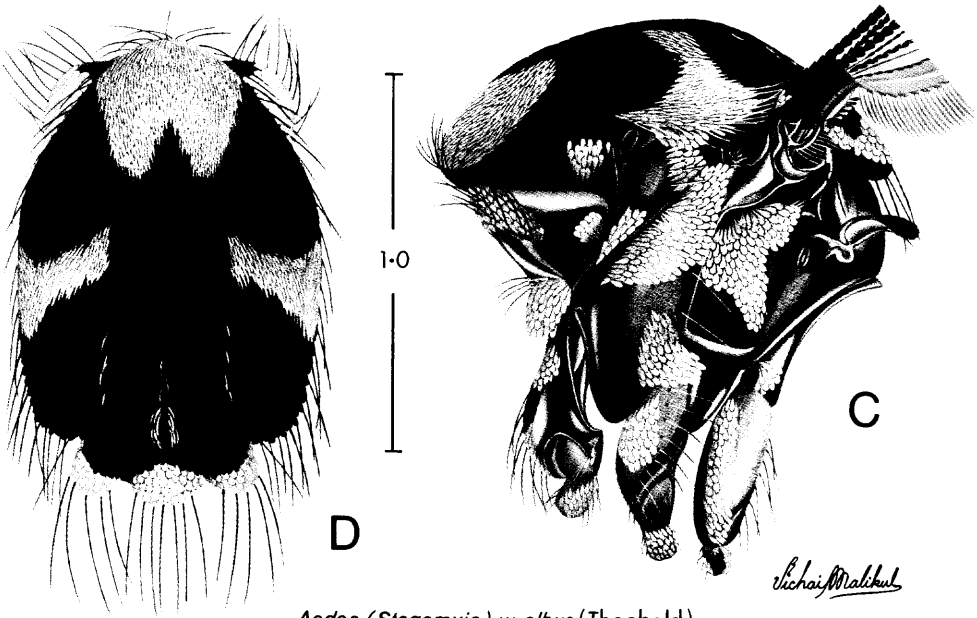


Aedes (Stegomyia) gardnerii gardnerii (Ludlow)

Fig.32

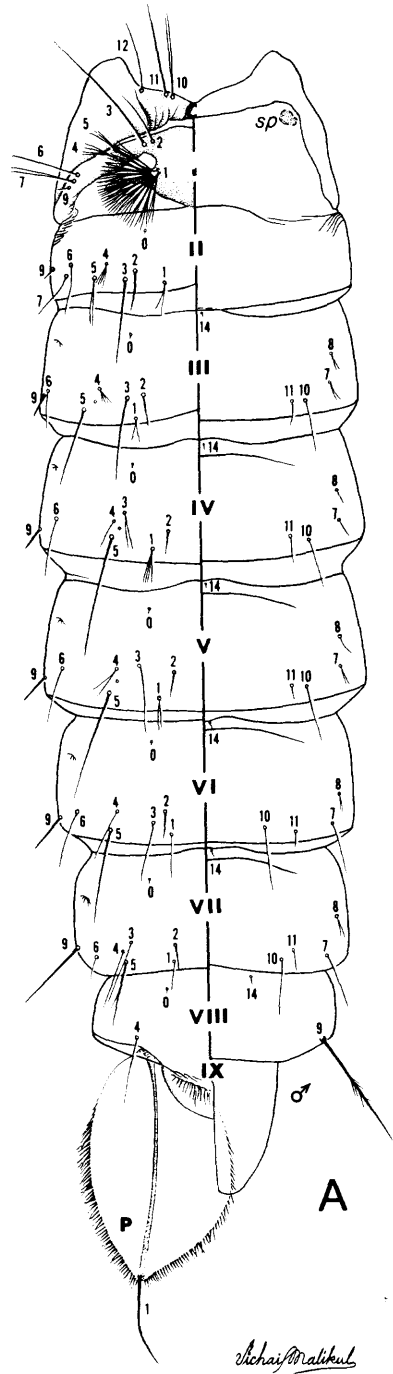
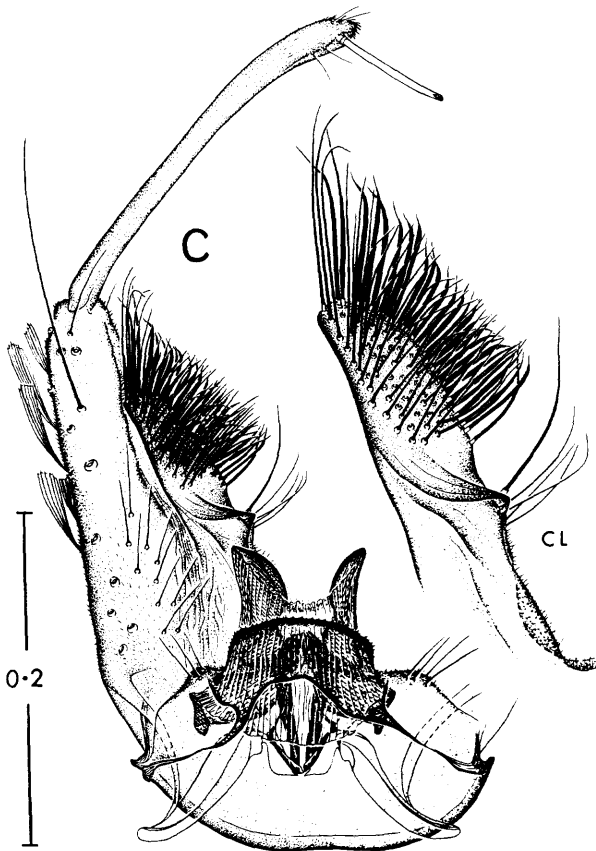
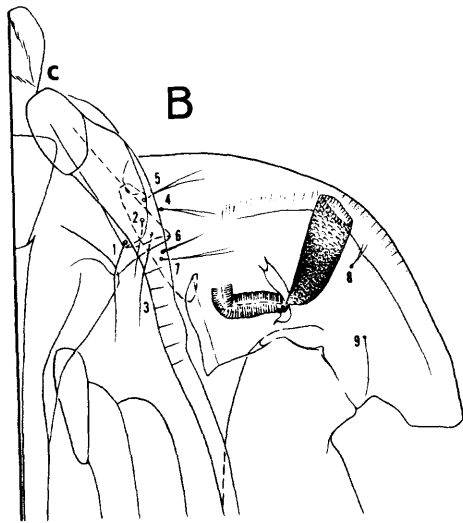


Aedes (Stegomyia) gardnerii imitator (Leicester)



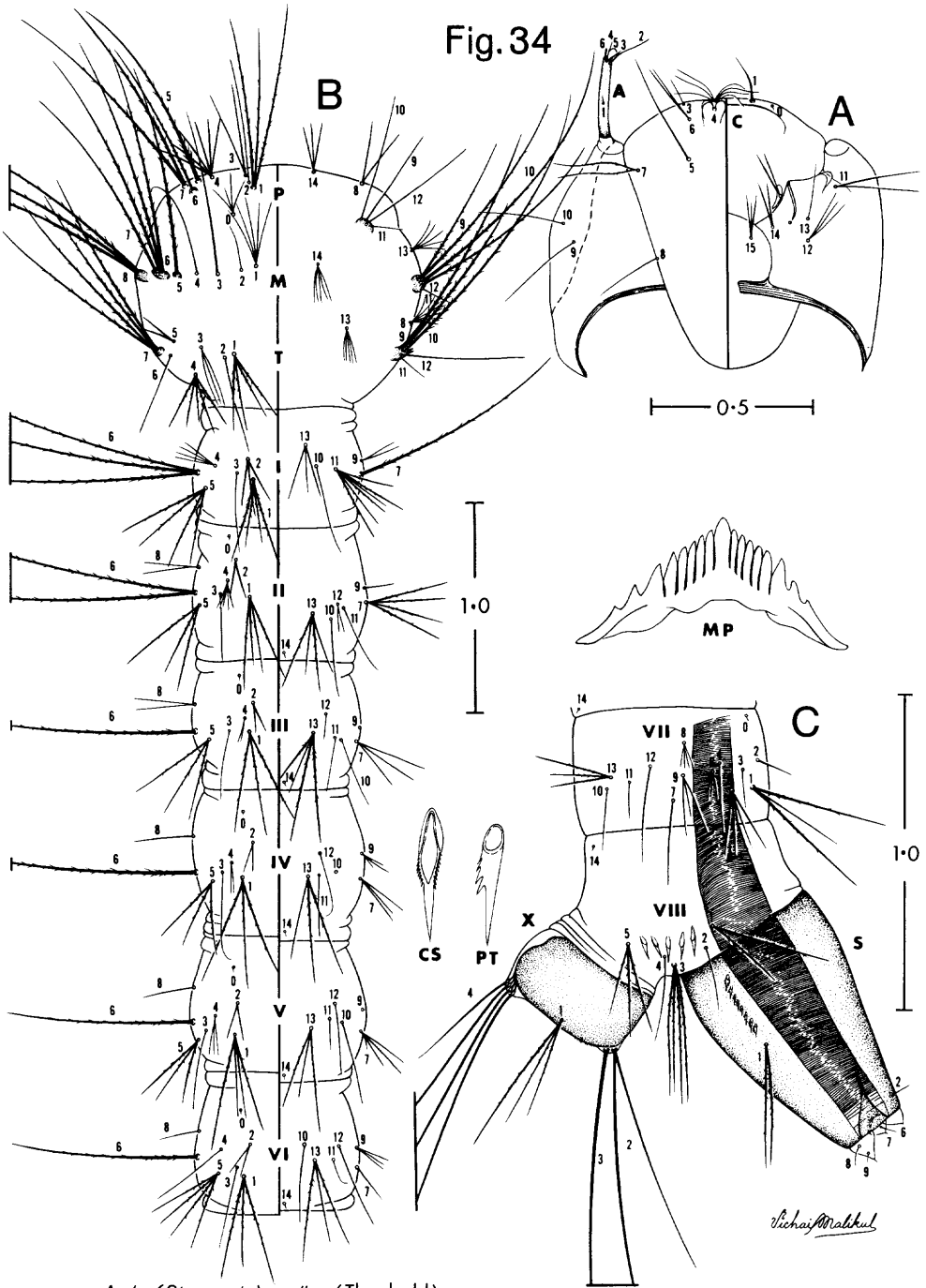
Aedes (Stegomyia) w-albus (Theobald)

Fig.33



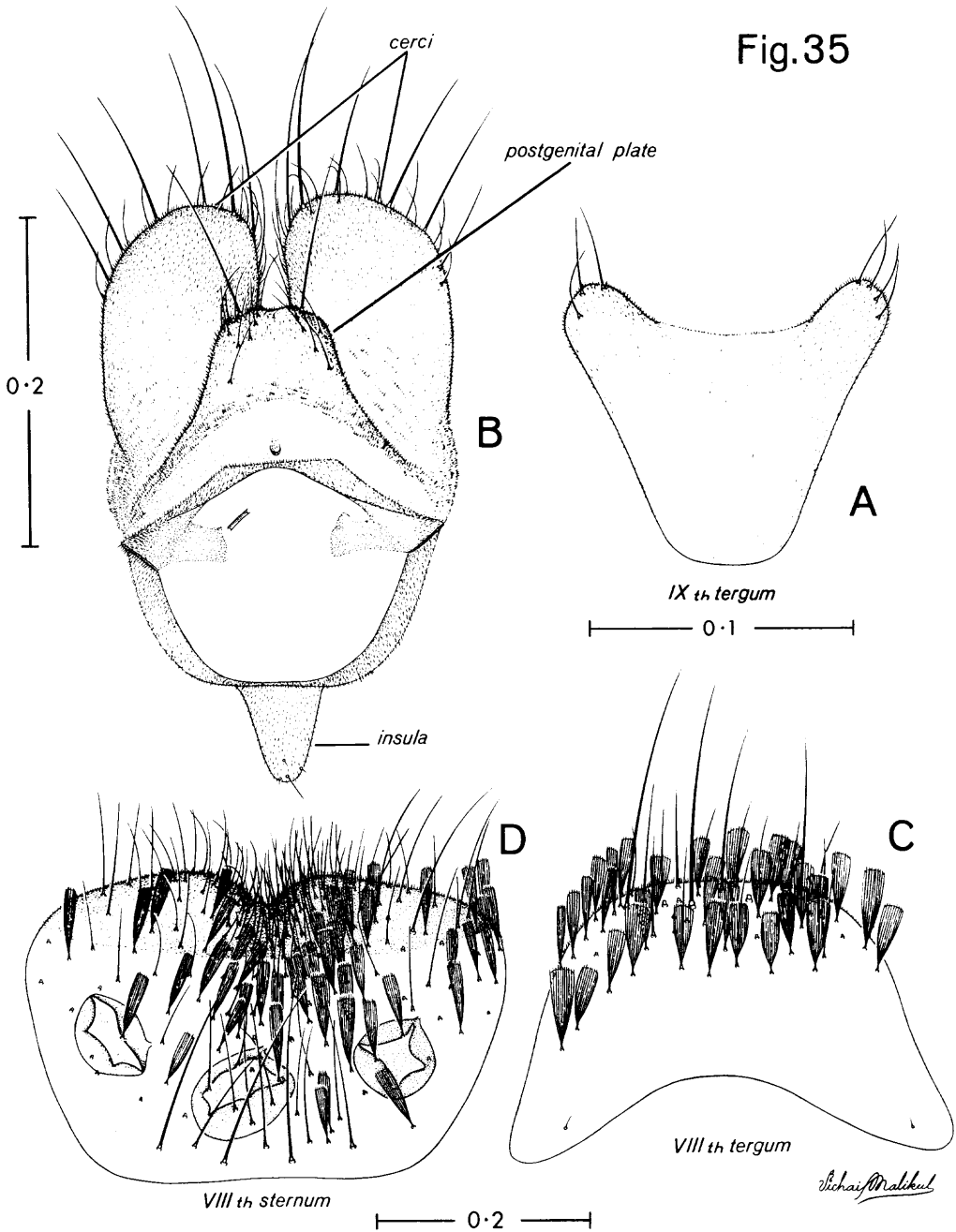
Aedes (Stegomyia) w. albus (Theobald)

Fig.34



Aedes (Stegomyia) w-albus (Theobald)

Fig.35



Aedes (Stegomyia) w-albus (Theobald)

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Names of valid taxa are in roman type; synonyms are in italic type. Italic numerals refer to the principal text references. Roman numerals refer to secondary text references; the suffix "k" indicates mentioning in a key and the suffix "t" indicates mentioning in a table. Roman numerals in parentheses without a suffix refer to the figures and with the suffix "m" indicates mentioning to a map.

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MEDICAL ENTOMOLOGY STUDIES - VIII.

NOTES ON THE TAXONOMIC STATUS OF *Aedes vittatus* (DIPTERA: CULICIDAE)¹.

By

Yiau-Min Huang²

ABSTRACT

Aedes vittatus (Bigot) heretofore placed in the subgenus *Stegomyia* Theobald is transferred to the subgenus *Aedimorphus* Theobald. This conclusion was reached after a critical study and consideration of all known stages. Both sexes, larva and pupa of this species are redescribed, illustrated and its affinity is discussed.

INTRODUCTION

Edwards (1932) divided the subgenus *Stegomyia* Theobald of *Aedes* into 4 groups which he designated A, B, C and D, and placed *Aedes vittatus* (Bigot) in "Group D," a monotypic species group. Barraud (1934), Hopkins (1952), Mattingly (1965) and Service (1970) also placed it in the subgenus *Stegomyia* and considered it as an atypical or aberrant species of *Stegomyia*. After a critical study of both adults and the immature stages I believe that it is not a *Stegomyia* and should be removed from this subgenus. It shows a close resemblance to the subgenus *Aedimorphus* Theobald of *Aedes*, particularly with some rather basic genitalic characters in common with the *vexans* group of the subgenus *Aedimorphus*. Therefore, I am placing it in this subgenus.

The nomenclature for the chaetotaxy of the larva and pupa and the terminology of the structural parts of the adult as used in this paper largely follows Belkin (1962).

¹This work was supported by Research Contract No. DA-49-193-MD-2672 and DAMD-17-74C-4086 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, Washington, D. C.

²Medical Entomology Project, Department of Entomology, Smithsonian Institution, Washington, D. C. 20560.

Aedes (Aedimorphus) vittatus (Bigot)
(Figs. 1A; 2B, C; 3; 4; 5; 6)

Culex vittatus Bigot 1861: 227 (♀).

Stegomyia sugens Theobald (nec Wiedemann) 1901: 300; Edwards 1912: 9 (synonymized *Scutomyia sugens*, *Stegomyia brumpti* and *Reedomyia albopunctata*).

Scutomyia sugens Theobald 1905: 19.

Stegomyia brumpti Neveu-Lemaire 1905: 9 (♂, ♀*).

Reedomyia albopunctata Theobald 1907: 262 (♀).

Stegomyia vittata (Bigot), Edwards 1917: 210 (synonymized *Culex vittatus*, *Stegomyia sugens*, *Stegomyia brumpti* and *Reedomyia albopunctata*); Barraud 1923: 777 (♂*, ♀); Borel 1928: 77 (♂*, ♀, L*).

Aedes (Stegomyia) vittatus (Bigot), Edwards 1925: 265; Edwards 1932: 161; Barraud 1934: 245 (♂*, ♀*, L*); Edwards 1941: 155 (♂*, ♀*), 391 (P*); Hopkins 1952: 160 (L*); Mattingly 1952: 255, 291 (zoogeography); Senevet and Andarelli 1954: 320 (L*); Mattingly and Knight 1956: 93, 100 (L*; taxonomy); Senevet and Andarelli 1958: 273 (P*); Mattingly 1965: 53 (♂*, ♀*, P*, L*); Service 1970: 129 (♂*, ♀*, P*, L*; biology and taxonomy).

MALE (Fig. 1A). *Head*. Proboscis dark scaled, without pale scales on ventral side, as long as forefemur; palpus dark, distinctly longer than proboscis, with white basal band on each of segments 2-5; segments 4, 5 subequal, slender, upturned and with a few short setae; segment 4 with some distinct long bristles along ventral-lateral sides as well; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales on inner and outer sides; decumbent scales of vertex largely broad and flat; erect forked scales dark, not restricted to occiput; vertex with a median stripe of broad white scales mixed with a few narrow white ones, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of white broad scales ventrally; a few narrow white scales scattered on occiput area and a few broad white scales on eye margin. *Thorax*. Scutum with narrow dark scales and 3 pairs of prominent small white spots of narrow scales on anterior 0.67 of scutum (on fossal area, posterior fossal area and on about the level of wing root); the anterior 2 pairs of white spots usually larger than the posterior pair; some narrow white scales on anterior promontory and a few narrow white ones on scutal angle area; a patch of broad white scales on lateral margin just before level of wing root and some narrow white ones dorsally; a few narrow white scales on posterior portion of supra-alar area; prescutellar space surrounded by narrow white scales and a few narrow white scales on posterior dorsocentral area; acrostichal and dorsocentral setae present; scutellum with broad white scales on all lobes and with a few broad dark ones at the apex of midlobe; postnotum bare; anterior pronotum with broad white scales, sometimes with a few dark ones towards midline; posterior pronotum with broad white scales mixed with a few narrow white ones above and with some broad and narrow dark scales dorsally; spiracular setae absent; postspiracular setae present; paratergite without or with a few broad white scales; patches of broad white scales on propleuron, on the postcoxal membrane, hypostigial, subspiracular, postspiracular and prealar areas, on the upper and lower portions of sternopleuron and on the upper portion of mesepimeron; upper sternopleural scale patch does not reach to anterior corner of sternopleuron; lower mesepimeron with 2 (1-3) setae; metameron bare. *Wing*.

With dark scales on all veins except for a minute basal spot of white scales on costa; R_2 about equal to R_{2+3} . *Halter*. With pale scales. *Legs*. Coxae with patches of white scales; knee-spots present on all femora; all femora anteriorly dark with some white scales scattered, more so on mid- and hind- than on forefemur and each with a white band at about apical 0.25; all tibiae dark, each with a subbasal white spot and a white band at about basal 0.33 on fore- and mid- and at about 0.5 on hindtibia; fore- and midtarsi with basal white bands on tarsomeres 1-3; hindtarsus with basal white bands on tarsomeres 1-4; the ratio of length of white band to the total length of tarsomere is 0.40, 0.40, 0.50 and 0.75; tarsomere 5 all white or sometimes with a few dark scales on the apical ventral side; fore- and midlegs with tarsal claws unequal, all toothed; hindleg with tarsal claws equal, simple. *Abdomen*. Segment I with white scales on laterotergite; tergum I with a large median white spot; terga II-VII each with a basal white band and with lateral white curved markings which do not connect with the basal bands; sternum VIII largely covered with white scales. *Terminalia* (Fig. 3). Basimere elongate, about 3.5 times as long as wide, its scales restricted to lateral and ventral areas, with a patch of bristles on apicomesal area of ventral surface; claspette present, large, with spines along mesal edge, recurved setae on basal corner of expanded distal part, with some setae scattered on inner apical area and very fine setae on outer basal area; distimere irregular in shape, about 0.74 as long as basimere, greatly expanded apically, with numerous fine setae and some longer ones on dorsal side and with numerous spine-like setae on ventral side; a few setae near base of terminal appendage, which is a long, strongly curved spiniform process at the base of expanded distal part; aedeagus complex, rather small, widened subbasally, with several lateral teeth and about 4 apical curved ones on each side; paraprocts without teeth; cercal setae absent; tergum IX narrowed medially and with a distinct setose lobe on each side; tergum VIII rounded apically and with numerous long, stout bristles.

FEMALE. Essentially as in male, differing in the following respects: *Head* (Figs. 2A, B). Proboscis with pale yellowish scales occupying about middle 0.33-0.40; palpus 5-segmented, about 0.33 of proboscis, with white scales on less than apical half and with 2 or 3 white scales on the apex of 3rd segment, or sometimes with a few white scales on the base of 3rd segment as well, segment 5 small; antenna with some broad white scales on the inner side of first flagellomere; clypeus with a small patch of narrow white scales on each side; erect forked scales more numerous extending forward on to the vertex than in male; vertex with a median stripe of narrow white scales and with a few narrow white scales scattered on occiput area and on eye margin. *Thorax*. Anterior pronotum with broad white scales mixed with a few narrow white ones towards outside and with some broad and narrow dark scales towards midline; lower mesepimeron with 2-5 setae. *Wing*. With basal costal spot and a few pale scales scattered on costa and radius (R) veins; cell R_2 about 1.5 times as long as R_{2+3} . *Legs*. Fore- and midlegs with tarsal claws equal, all toothed. *Abdomen*. Segment VIII completely retracted. *Terminalia* (Figs. 4C, 6). Sternum VIII with deep notch at middle; insula longer than broad, with minute setae and with 6 (5-10) longer ones on apical 0.25-0.33; tergum IX with well developed lateral lobes and with 5-7 setae; post-genital plate rather narrow and small, sometimes with shallow notch; cerci long; 3 spermathecae, one slightly larger than the other 2.

PUPA (Figs. 4A, B). *Cephalothorax*. Trumpet short, about 3 times as long as wide in the middle; seta 1, 3-C usually single, longer than 2-C; 2-C usually single (1-2); 4-C single or 2-branched, longer than 5-C; 5-C with 2 or

3 branches; 6-C usually single (1-2), much shorter than 7-C; 7-C with 2 or 3 branches; 8-C at a short distance before the base of the trumpet; 10-C with 2-6 branches, mesad and caudad of 11-C; 11-C single, long, stout and barbed.

Abdomen. Seta 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I widely separated, distance between them twice the distance between 4, 5-I; 1-II well developed, usually with 8-14 branches; 1-III usually with 3 branches (3-4); 1-IV usually with 4 branches (3-5); 2-III-V mesad of 1, 3-III-V; 3-II, III single, or sometimes 3-II 2-branched, shorter than segment III; 5-IV-VI single, not reaching beyond the posterior margin of the following segment; 4-VII usually single, longer than 5-VII; 6-VI single, longer than 9-VI; 9-I-VI small, single; 9-VII, VIII strongly developed, branched; 9-VII usually with 3 branches (2-6) and barbed; 9-VIII usually with 6 branches (6-10) and barbed. *Paddle.* Oval, margins without hair-like fringe, with small, short spines on basal 0.8 of outer margin; inner margin very faint and without spines; seta 1-P single, strongly developed, thickened. Genital lobe with fine spicules laterally and apically.

LARVA (Fig. 5). *Head.* Antenna 0.5 length of head, with a few fine spicules; 1-A inserted on basal half of shaft, usually with 2-4 branches and barbed; inner mouth brushes pectinate at tip; seta 4-C very small, with 2-3 branches, closer to 6-C than 5-C, caudomesad of 6-C; 6-C single, stout; 4, 6-C at about level of antennal base; 5-C single, long and barbed, considerably caudad and slightly mesad of 6-C; 7-C with 4 or 5 branches and barbed; 8, 9 and 10-C single; 11-C with 3 branches; 12-C small, with 2 or 3 branches; 13, 14-C single; 15-C with 3 or 4 branches; mentum with 13-14 teeth on each side. *Thorax.* Seta 1-P single, long and barbed; 2-P single; 3-P double; 4-P single; 5, 6-P single, long and barbed; 7-P usually with 3 branches (2-3), long and barbed; 8-P with 2 or 3 branches, long and barbed; 9-P single; 11-P usually with 2 branches (1-2); 14-P double; 5, 7-M single, long and barbed; 6-M with 4-7 branches, long and barbed; 8-M usually with 6 branches, long and barbed; 9-M with 4-6 branches, long and barbed; 10 and 12-M single, long, stout and barbed; 11-M single, small; 7-T with 4-7 branches, long and barbed; 9-T usually with 3 branches (2-3), long and barbed; 10 and 11-T similar to those on mesothorax; 12-T single, much reduced. *Abdomen.* Seta 6-I-IV usually with 2 branches, long and barbed; 7-I, II usually with 2 branches (2-3), long and barbed; 6-V, VI single, long and barbed; 12-I not present; 5-II-V single, small; 13-III-V single; 1-VIII small, with 4-6 branches; 2-VIII distant from 1-VIII; 2, 4-VIII single; 3-VIII well developed, with 7-9 branches and barbed; 5-VIII much larger than 1-VIII, with 2-4 branches and barbed; comb of 6-10 (usually 8) scales in a single irregular row, each scale with fine denticles or fringes at base and with long apical spine. Saddle incomplete, without marginal spicules; 1-X single, short; 2-X with 5 branches; 3-X single, long; ventral brush (4-X) with 4 pairs of setae on grid, each with 3-7 branches; with 4 pre-cratal tufts, each with 5-9 branches; anal papillae long, about 4 times as long as saddle, slender and tapered. *Siphon.* Short, about 2 times as long as wide; acus present; 19-25 pecten teeth, the more proximal smaller, close-set, the distal one widely spaced, each tooth with 1-4 basal denticles; seta 1-S with 4-6 branches and barbed, inserted before last tooth and beyond middle of siphon.

TYPE-DATA. *Culex vittatus* Bigot, type-female, non-existent; type-locality: Corsica; *Stegomyia brumpti* Neveu-Lemaire, cotypes, male and female, non-existent; type-locality: Harrar, (Hararge), Ethiopia; *Reedomyia albopunctata* Theobald, type-female, in poor condition, in BMNH; type-locality: Sierra Leone (Major Smith).

DISTRIBUTION. 1,818 specimens examined: 612♂, 552♀, 60♂ terminalia,

38♀ terminalia, 56 L, 359 individual rearings (161 l, 339 p).

ADEN. (II-1895), 1♀; Hriotalon (Dr. Patton), 1♂, 3♀; Hinterland, 1♀; W. Aden Protectorate, Jebel Jihaf, 7, 100 ft (X-1937), 4♂, 4♀.

BOTSWANA. (BECHUANALAND PROTECTORATE), Kasane (1946, B. De M.), 1♂, 1♀.

CAMBODIA. *Kandal*: Oudong (VII-1968), 10♂, 5♀, 2♂ terminalia.

CAMEROON. (CAMEROONS), Yaoundé (J. Rageau) 1♂.

CHINA. *Hainan I.* - (1934), 6♂, 5♀.

ETHIOPIA. (ERITREA), Mt. Ramlu, 3, 000-4, 000 ft (II-1950, H. Merlin), 2♂.

FRANCE. *Corsica*: San Nicolao (VIII-1944), 5♂, 3♀; (X-1968, J. Mouchet), 2♂, 1♀; Ponte Leccia (X-1968, J. Mouchet), 6♂, 6♀, 2♂ terminalia, 4♀ terminalia; *Banyuls*, (IX-1952), 1♀.

GHANA. (GOLD COAST), Bole (1911, Dr. A. Ingram), 2♂, 1♀; Sunyani, Ashanti (1915, Dr. A. Ingram), 1♀.

INDIA. (Christophers), 1♂, 2♀, 1♂ terminalia; (James), 3♂, 2♂ terminalia; (1910, Giles), 1♀; (1921), 1♂; 1♂, 1♀, 1♂ terminalia; *Bihar*: Darbhanga - Pusa (15-VII-13), 2♀; *Delhi*: (XII-1968, M. K. K. Pillai), 6♂, 1♀; *Kanara*: Karwar (Dr. H. Cogill), 3♂, 3♀; *Punjab*: Umballa (25-VIII-05, H. J. W. Borrow), 2♀; (VIII-1905), 1♀; Ambala (VIII-1923, P. J. Barraud), 2♂, 2♀; Pinjaur near Kalka (IX-1931, P. J. Barraud), 5♂, 1♀.

ITALY. *Sardinia*: Riopicocca (VII-VIII-47), 3♀; Sarrabus Ponte Picocca (VIII-1947), 1♀.

KENYA. Nairobi (VI-1935), 3♂, 5♀, 8 individual rearings (8 l, 8 p).

MALAWI. (NYASALAND), (XI-29), 1♂.

MALAYSIA. *Peninsular Malaysia*: *Langkawi Is.* - (IV-1928), 1♂; *Penang Is.* - Telok Kumbor (I-1969, James, Chia & Sulaiman), 1♂, 2♀, 1♂ terminalia, 1♀ terminalia, 3 individual rearings (2 l, 2 p).

NIGERIA. Oshogbo (IV-1911, Dr. T. F. G. Mayor), 1♂, 1♀; Baro (X-1910), 1♀; Lokoja, 1♂; Anara, Arora, Ioria, Jos, Kaduna River (VI-1960-VIII-1961, M. W. Service), 6♂, 4♀.

SAUDI ARABIA. Wadiyain (VIII-1936), H. St. J. B. Philby), 2♀.

SIERRA LEONE. (Major Smith), 1♀; Freetown (IX-99, E. E. Austen), 2♂, 2♀, 1♂ terminalia; Daru (VI-1911, Dr. J. C. Murphy), 1♀; (VI-1912), 1♀; (II-1925, Major Fraser), 1♀.

SOMALIA. (BR. SOMALILAND), Buran, 3, 000 ft (IX-1930), 3♂, 2♀.

SOUTH AFRICA. *Messina*, Groot Belai (III-1934), 1♀; *Johannesburg*, N. Bryanston (A30/46), 1♂, 1♀; *Transvaal*: Brits (1913), 1♂, 1♀; Tzaneen (VI-1934), 1♂; Potgietersrus (1953), 1♀; Sabie Bungalow Hotel (SAIMR, CSIR-54, Coll. No. E. T. 562, J. Muspratt), 1♂, 1♀; *Natal*, Keate's Drift (1952), 1♂.

SOUTHWEST AFRICA. Okimbahe (1950, B. De M.), 1♂, 1♀.

SPAIN. *Cáceres Province* - Cuartos (? = Cuacos), (1935, J. Gil Collado), 1♂, 1♀; (1935), 1♀.

SRI LANKA. (CEYLON), (1921, P. J. Barraud), 4♀; *Central Province*: Suduganga (IX-1919), 3♂; *Kandy Dist.* - Peradeniya (I-1971, Piyadasa & Somapala), 1♂; *North Central Province*: *Anuradhapura Dist.* - Hunuwilagama, Wilpattu, 200 ft (III-1970, D. R. Davis & W. H. Rowe), 3♂, 1♂ terminalia; *Northern Province*: *Vavuniya Dist.* - Paraiyanalankulam, 100 ft (III-1970, D. R. Davis & W. H. Rowe), 1♂; *Sabaragamuwa*: *Ratnapura Dist.* - Uggalkaltota, 350 ft (I-II-1970, D. R. Davis & W. H. Rowe), 1♂, 1♀; Panamure, 500 ft (X-1970, O. S. Flint, Jr.), 1♀.

SUDAN. Hills E. of Erkowit (II-1908), 1♀; (IV-34), 1♂.

TANZANIA. (TANGANYIKA), *Ukara I.* (1915, A. Smith), 6♀; (1952), 2♀; Lindi (1923, Dr. W. E. Haworth), 1♂, 1♀.

THAILAND. *Chiang Mai*: Huey Keo (III-1952-II-1953, D. C. & E. B. Thurman), 119♂, 71♀, 6♂ terminalia; Doi Suthep, Maerim, Muang (1962-1964, SEATO), 15♂, 22♀, 4♂ terminalia; Rong Rian Choeng Doi (IV-1970, Kol & Sanit), 9♂, 16♀, 4♂ terminalia, 7♀ terminalia, 21 L, 25 individual rearings (21 l, 22 p); Ban Om Kut, Ban Pang Kwang (VI-X-1970, Kol & team), 10♂, 11♀, 3♀ terminalia, 21 individual rearings (10 l, 13 p); *Chon Buri*: Bang La Mung, Had Hin Klom, Ko Si Chung (1963-1964, SEATO), 19♂, 27♀, 11♂ terminalia; Bangphra (1967, SEATO), 3♂, 1♀, 4 individual rearings (1 l, 4 p); *Kanchanaburi*: Huai Bong Ti, Huai Lan Sang, Huai Mae Nam Noi, Khao Na Chang, Sapan Mae Nam Kwde, Tamakam (1964-1965, SEATO), 39♂, 43♀; *Khon Kaen*: Ban Maung Kao, Ban Nong Khu, Phu Wiang (VII-1966, Somboon, Chaliou, Kol), 21♂, 22♀, 3♂ terminalia, 1 individual rearing (1 p); *Lampang*: Ngao (VII-1952, SEATO), 1♂, 1♀; (V-1968, Harrison), 5♂, 5♂ terminalia, 3 L, 5 individual rearings (5 p); *Mae Hong Son*: Mae Sariang (V-1969, Chaliou & Samarn), 43♂, 36♀, 3♂ terminalia, 9♀ terminalia, 56 individual rearings (22 l, 56 p); *Nakhon Nayok*: Huey Tak Kong, Khao E. To (1964, SEATO), 7♂, 3♀; *Nakhon Ratchasima*: Koraj Pak Chong, Lamu Huey Tha Krong (1964-1965, SEATO), 2♂, 5♀, 1♂ terminalia; Ban Phak Kong Thang, Ban Wang Mut (V-1967, SEATO), 1♂, 6♀, 7 individual rearings (6 p); *Nakhon Sawan*: Ban Talat Tai (XI-1968, Kol & team), 2♂, 2♀, 2♂ terminalia, 4 individual rearings (1 l, 4 p); *Prachin Buri*: Ban Bu Phram (VII-1971, Kol & team), 7♀, 4♀ terminalia, 7 individual rearings (3 l, 7 p); *Prachuap Khiri Khan*: Huai Yang Phrach Khwa (IV-1968, Chaliou, Somboon, Kol), 33♂, 21♀, 3♀ terminalia, 5 L, 48 individual rearings (29 l, 48 p); *Surat Thani*: Khao Phlu, Khao Yai (1966, SEATO), 8♂, 33♀, 6♂ terminalia, 2♀ terminalia; *Ko Samui I.* - Ban Lamai, Laem Chong Klum, Laem Thong Lak, Laem Yai (IX-X-1967, SEATO), 109♂, 61♀, 119 individual rearings (52 l, 116 p); (1968, SEATO), 22♂, 27♀, 4♀ terminalia, 27 L, 41 individual rearings (3 l, 37 p); Ao Thong Yang (XI-1971, Kol & team), 4♂, 6♀, 10 individual rearings (9 l, 10 p); *Tak*: Huai Lan Sang (1965, SEATO), 6♂, 3♀.

UGANDA. (VIII-1910), 1♂; Metu (III-1953), 3♂, 6♀; Entebbe (V-1911), 1♀.

UPPER VOLTA. Bobo-Dioulasso (1949, M. Holstein), 3♂.

VIETNAM. *Bien Hoa*: (1964), 3♂, 6♀; *Binh Dinh*: An Khe (V-1966), 1♀; *Darlac*: Ban Me Thuot, 500 m (V-1960, L. W. Quate), 1♀; *Khanh Hoa*: Cam Ranh Bay (VI-VIII-1966), 2♂, 1♀; Duc My (IX-X-1966), 6♂, 6♀, 4♂ terminalia, 1♀ terminalia; *Pleiku*: 300 m (V-1960, L. W. Quate), 8♂; *Quang Nam*: Kim Lien Miller (IX-1968), 5♂, 1♀; *Quang Tri*: (VI-1961), 1♀.

YEMEN. *Socotra I.*: Kallansiya (4-I-43), 1♀.

ZAIRE. Stanleyville (XI-1927, Dr. J. Schwetz), 1♂; (1930, Dr. Richard), 2♂, 1♀; Matadi (V-1948, P. H. Vercammen), 1♂.

ZAMBIA. (N. RHODESIA), Livingstone (1946), 1♀.

ZANZIBAR. (1919), 1♀.

TAXONOMIC DISCUSSION. *Aedes vittatus*, formerly placed in the subgenus *Stegomyia*, differs greatly from all other members of *Stegomyia* and should be excluded from that subgenus. It is more similar in both adult and immature stages to members of the subgenus *Aedimorphus* than to *Stegomyia*, particularly in having some rather basic genitalic characters in common with the *vexans* group of *Aedimorphus*. I believe that it should be placed in the subgenus *Aedimorphus* rather than in the subgenus *Stegomyia*.

Adults of both sexes of this species can easily be distinguished from those of *Stegomyia* by the numerous erect forked scales on the head, not restricted to occiput and presence of acrostichal setae. The male terminalia of this species can easily be distinguished from those of *Stegomyia* by the irregularly

shaped distimere which is greatly expanded apically, with a long, strongly curved spiniform process subapically. The female terminalia of this species can easily be distinguished from those of *Stegomyia* by sternum VIII which has a deep medial V-shaped notch and by the long cerci. On the other hand, these characters which are markedly different from *Stegomyia*, are characteristics of *Aedimorphus*.

Superficially, the male palpus of *vittatus* resembles that of *Stegomyia* (except the *albolineatus* group which has the palpus dark) in having a white basal band on each of segments 2-5, segments 4, 5 subequal, slender, up-turned and with a few short setae. However, it differs in having the white basal band on segments 4, 5 complete dorsally. The female palpus of *vittatus* is very similar to that of *Stegomyia* (except the *albolineatus* group which has palpus dark) in having white scales on the apex. However, it differs from that of *Stegomyia* in the presence of a few white scales on segment 3 and with segment 5 well developed. These characters recall *Aedimorphus*. The male palpus of this species is by no means a typical *Aedimorphus* type but a rather reduced one. It is most nearly matched by some members of the Ethiopian *Aedimorphus* (*Aedes aerarius* McIntosh and *Aedes gibbinsi* Edwards).

The most important adult characters for determining the subgeneric position in the genus *Aedes* Meigen are those of the male terminalia. The male terminalia of this species appear to have some rather basic characters in common with 4 subgenera in genus *Aedes*, namely, *Aedimorphus*, *Diceromyia* Theobald, *Stegomyia* and *Ayurakitia* Thurman, suggesting affinities with these 4 subgenera. However, they have more characters reminiscent of *Aedimorphus* than of *Stegomyia*. In addition, with respect to the pupal and larval characters, *vittatus* does not conform to the subgenus *Stegomyia* at all.

The pupa of *vittatus* with seta 8-C slightly cephalad of the trumpet base, 1-II well developed, branched, 2-III-V distinctly mesad of 1-III-V, 9-VII, VIII strongly developed, branched, and barbed, paddle margins without hair-like fringe, with small, short spines on basal 0.8 of outer margin, inner margin very faint and without spines, 1-P single; can easily be distinguished from that of *Stegomyia*. On the other hand, these characters are shared with *Aedimorphus*.

The larva of *vittatus* is strikingly different from that of *Stegomyia* in having seta 4-C very small, mesad and caudad of 6-C; 4, 6-C at about level of antennal base and anal segment with 4 well developed precratal tufts. On the other hand, these characters are also those of *Aedimorphus*.

Reinert (1973) divided the male terminalia of Oriental species of *Aedimorphus* into 2 types. The male terminalia of *vittatus* are characteristic of Type II (*vexans* group). The larva of *vittatus* has seta 4-C very small, closer to 6-C than 5-C and mesad of 5, 6-C; 4, 6-C at about level of antennal base and 5-C considerably caudad and slightly mesad of 6-C which are also as in the *vexans* group. Differences from the *vexans* group include the broad, decumbent scales on the vertex and all lobes of the scutellum which recall some members of the *alboscuteallatus* group of *Aedimorphus*. However, the closest affinities of *Aedes vittatus* are with the *vexans* group. It thus seems that *Aedimorphus* is the most suitable subgenus for *vittatus* among the currently accepted subgenera of genus *Aedes*, and I am here making the subgeneric transfer.

Aedes vittatus is a very interesting species. Present evidence shows that it is somewhat a combination of several species groups of *Aedimorphus*. It exhibits similarity to the members of the subgenus *Aedimorphus* from both Oriental and Ethiopian regions as described above. On this basis, I am tentatively placing *vittatus* in a separate group. At present, it is felt that the taxo-

onomic position of *vittatus* and its relationship to other members of *Aedimorphus* can not be further discussed until a careful study of all stages of Ethiopian *Aedimorphus* has been completed.

Aedes vittatus is mainly confined to the Ethiopian region and the Oriental area (of Belkin 1962), with extensions into the southern part of the Palearctic and the northwestern part of the Indomalayan area.

Sharma and Chaudhry (1974) reported that they found a special strain which differed from the typical *Aedes vittatus* in the pattern of hindtarsus banding. In my opinion, their special strain has the same pattern of hindtarsus banding as the typical *Aedes vittatus* whose hindtarsus has basal white bands on tarsomeres 1-4, tarsomere 5 all white. In fact, Barraud (1934) did not describe the hindtarsus banding and the picture on Plate VII (Fig. 4) has the hindlegs incomplete. It only shows 4 tarsomeres; tarsomere 5 either was broken off or has all the white scales faded out. Therefore, the last tarsomere did not show clearly on the plate.

Since I have examined more than 1,000 adult specimens of *Aedes vittatus* through the entire range including topotypic material, museum type-material and Barraud's specimens, I have no doubt that the typical *vittatus* has the hindtarsus with basal white bands on tarsomeres 1-4, tarsomere 5 all white. Thus, the pattern which they thought to be "abnormal form" (Fig. 1, B) is, in fact, the typical form (normal form). In response to my request in August 1974, Dr. George B. Craig, Jr. of the University of Notre Dame, Indiana, has examined specimens from his 2 laboratory colonies of *vittatus*. The banding on the hindtarsi agrees with my interpretation of typical *Aedes vittatus*.

BIONOMICS. The immature stages of *vittatus* have been found mainly in rock pools and rock holes in Thailand, Malaysia, Vietnam, India and Africa. They have also been found in log holes in Thailand and Vietnam, in bamboo cups and tree trunks in Thailand. Presence of larvae in coconut palm crowns at Lindi, Tanzania, was an artifact resulting from deliberate introduction by the native collector (see Lester 1927, Wiseman et al. 1939). Immature stages have been found in association with *Aedes (Stegomyia) albopictus* (Skuse), *Aedes (Stegomyia) malayensis* Colless, and *Culex* sp. in Thailand, and with *Aedes malayensis* in Malaya.

Mattingly (1952: 271) stated that *vittatus* preferred rock pools, occasional utensils, hoofprints, boats, wells, tree holes and bamboo pots. Boorman (1961: 721) found that deep rock holes usually contained larvae of *vittatus*, particularly those where the water was clear and there was a layer of mud and a few dead leaves. Service (1970: 104) stated that larvae of this species are found predominantly in pools in rock outcrops or river beds, or even in pools formed in coral and on several occasions at the peak of the breeding season in open floodwater concrete drains.

In Thailand, this species was found mainly in partially shaded temporary small rock pools with fresh, colored water without algae in secondary deciduous forests or secondary rain forests, in a mountain area about 550-660 m or in small temporary rock pools surrounded by coconut palms and unshaded or partly shaded, situated in villages or beaches, along the sea coast, in that country at about sea level or 5-20 m. These contained brackish, clear or colored water, without algae.

Boorman (1961: 724) found that eggs survived desiccation for 10 weeks but not for 18 weeks. Service (1970: 141) found that eggs, fourth instar larvae and pupae were killed after 2 days exposure to 8-11°C and below, but little mortality resulted from exposure down to 15°C.

Boorman (1961: 720) took *vittatus* biting man in northern Nigeria in fair

numbers. Over most of its range it appears to bite man freely and will at least occasionally enter villages to bite. Mattingly (1965: 56) states that it is usually recorded as biting man freely, but not in South Africa. Service in northern Nigeria (1970: 141) found that no adults were caught in a Magoon trap baited with goats, sheep, monkeys and a pig; porcupine was the most important host in the area. He also stated that *vittatus* has a relatively short crepuscular biting period, with maximum activity between 1800 and 2100 hours.

MEDICAL IMPORTANCE. *Aedes vittatus* is a potential vector species. It can transmit yellow fever virus from monkey to monkey in the laboratory (Philip 1929) and has been suspected as a vector in the Nuba Mountain epidemic in Sudan (Lewis 1943).

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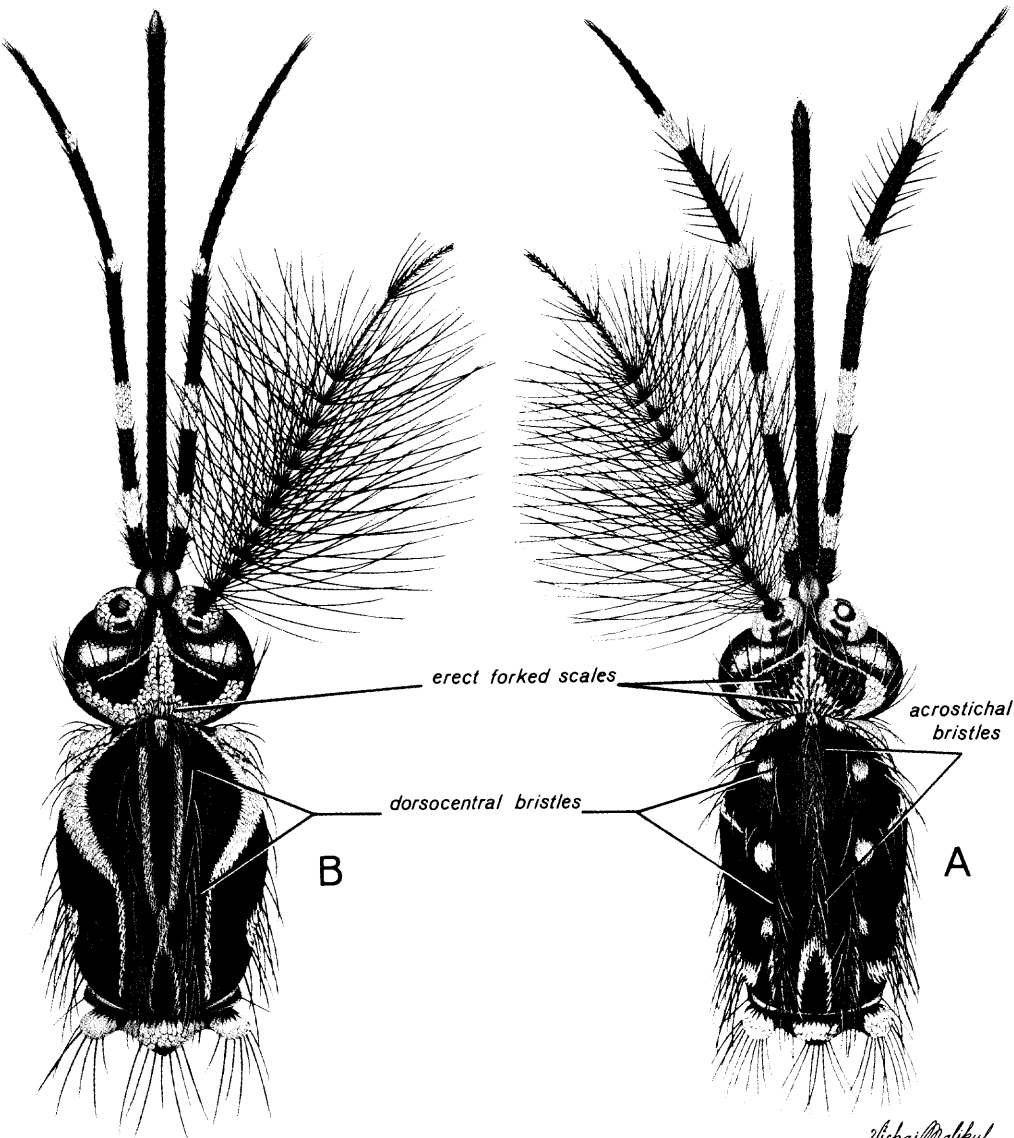
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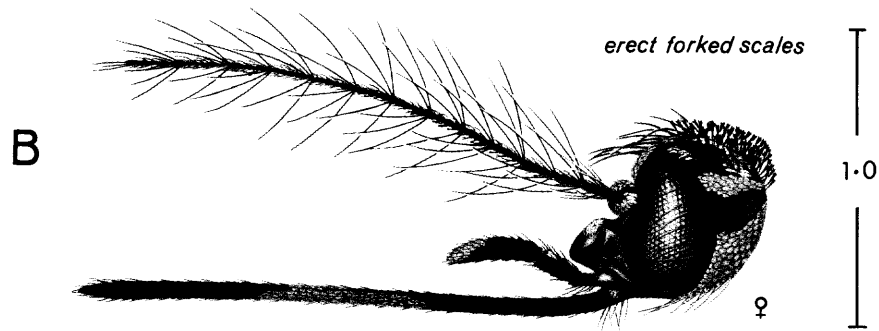
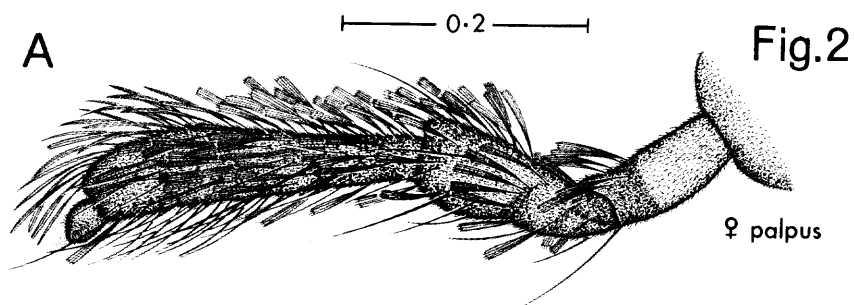
1. *Aedes (Aedimorphus) vittatus* (Bigot) - A, male adult;
Aedes (Stegomyia) aegypti (Linnaeus) - B, male adult.
2. *Aedes (Aedimorphus) vittatus* (Bigot) - A, female palpus; B, female head;
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3. *Aedes (Aedimorphus) vittatus* (Bigot) - A, B, C, D, E, F, male terminalia.
4. *Aedes (Aedimorphus) vittatus* (Bigot) - A, B, pupa; C, female terminalia.
5. *Aedes (Aedimorphus) vittatus* (Bigot) - A, B, C, larva.
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7. Distribution of *Aedes (Aedimorphus) vittatus* (Bigot).

Fig.1

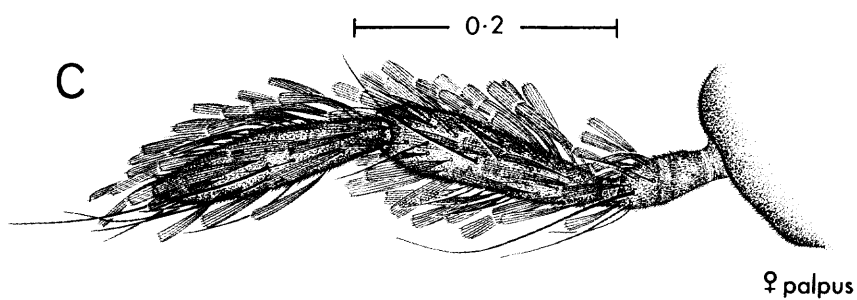


Aedes (Stegomyia) aegypti (Linnaeus)

Aedes (Aedimorphus) vittatus (Bigot)

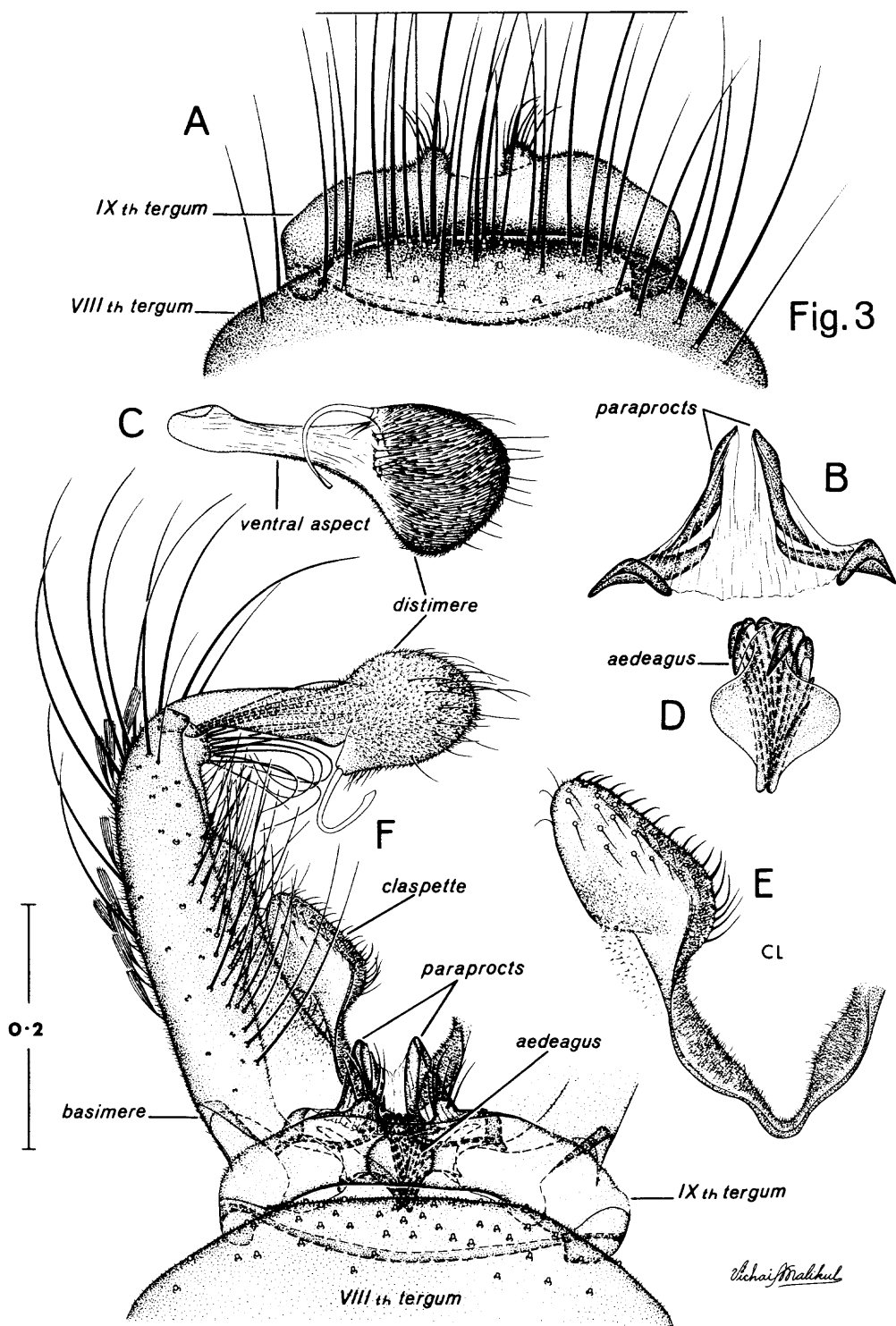


Aedes (Aedimorphus) vittatus (Bigot)



Aedes (Stegomyia) aegypti (Linnaeus)

Chai Malikul



Aedes (Aedimorphus) vittatus (Bigot)

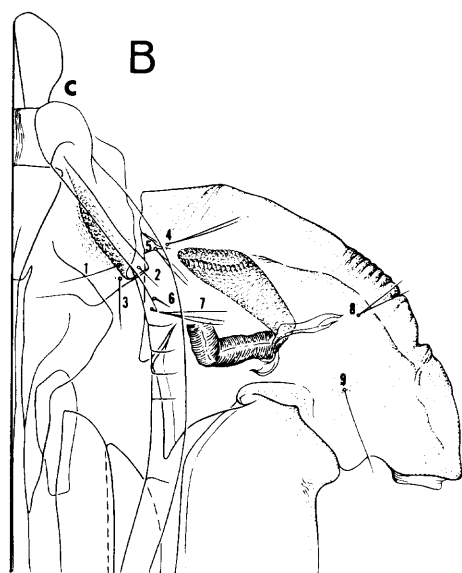
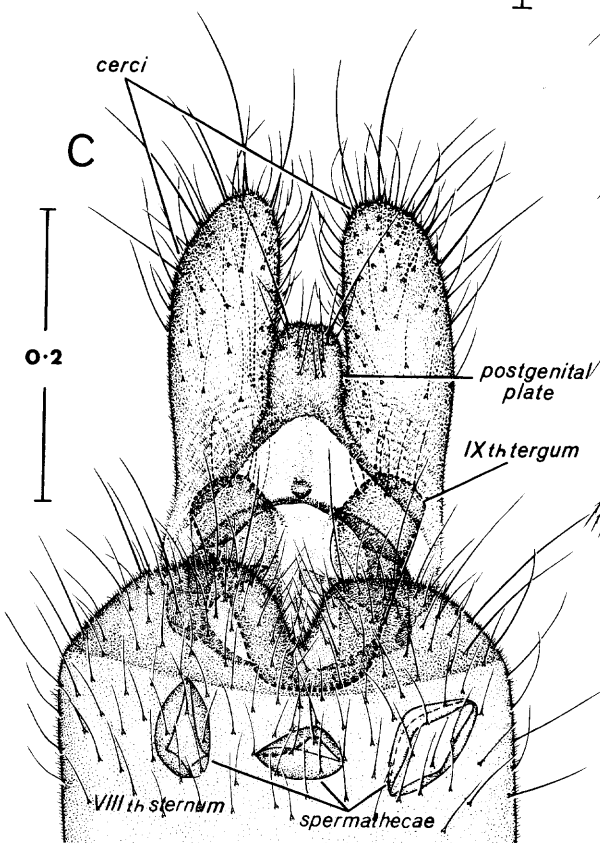
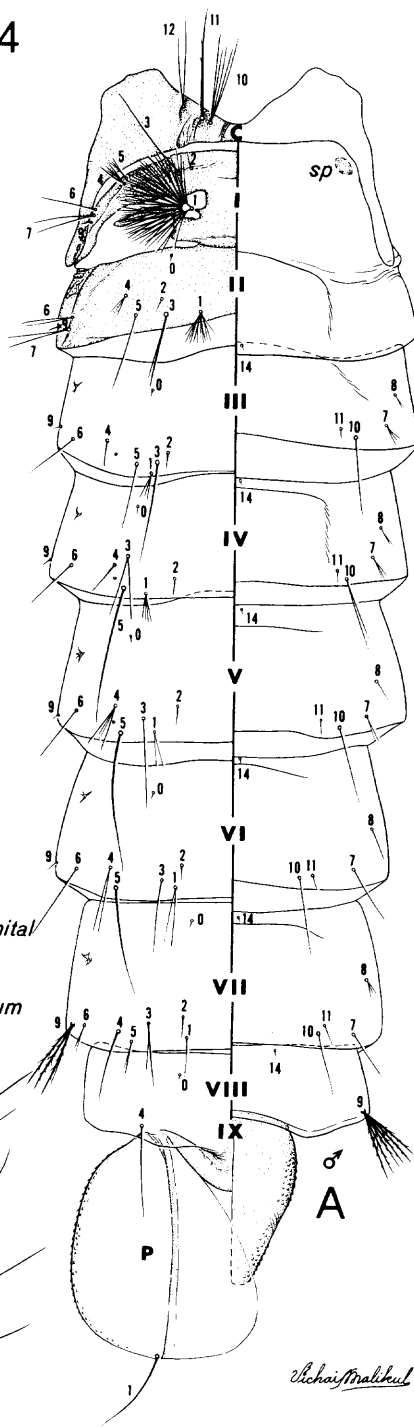
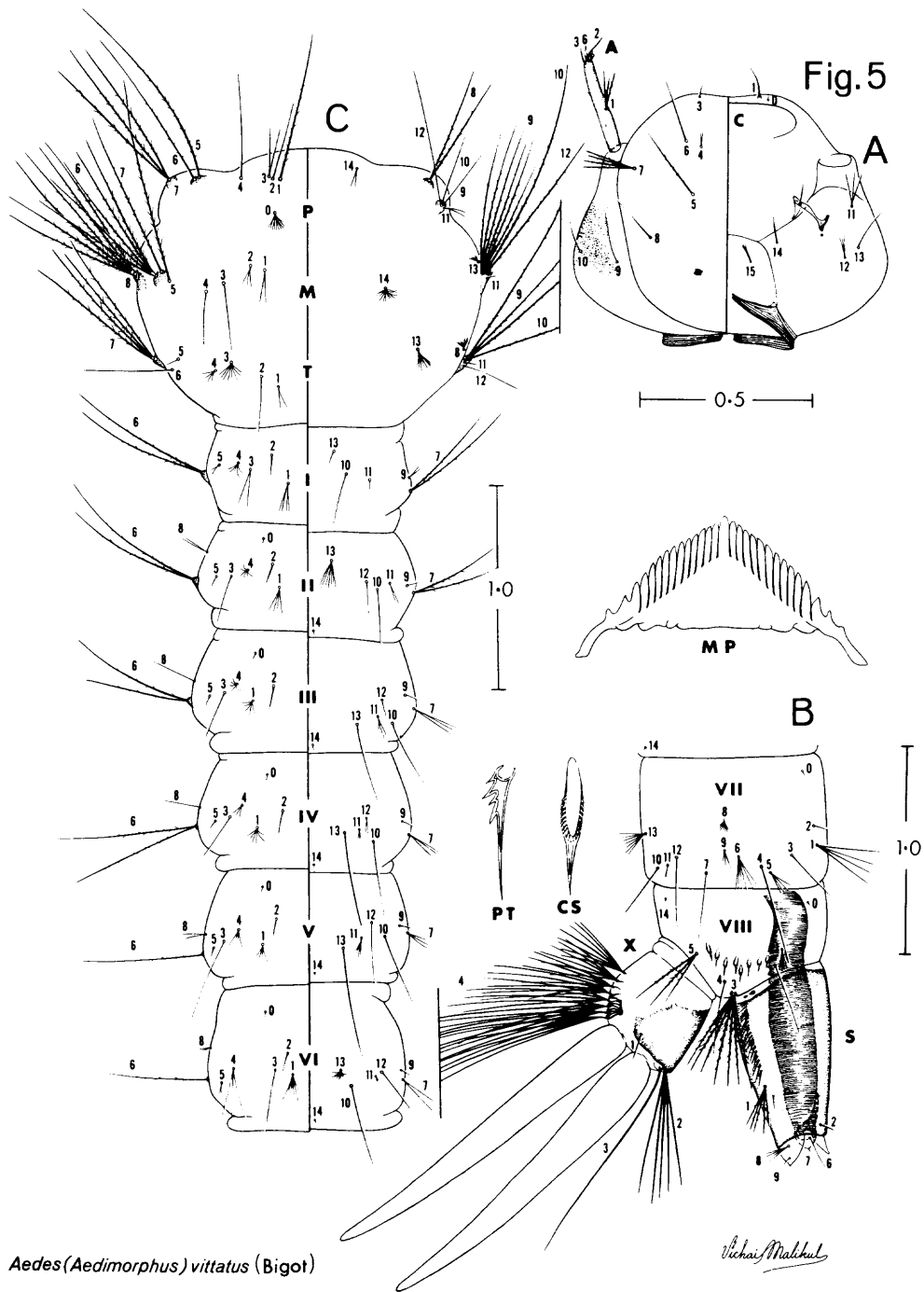


Fig.4



Aedes (Aedimorphus) vittatus (Bigot)

Uchajmalikul



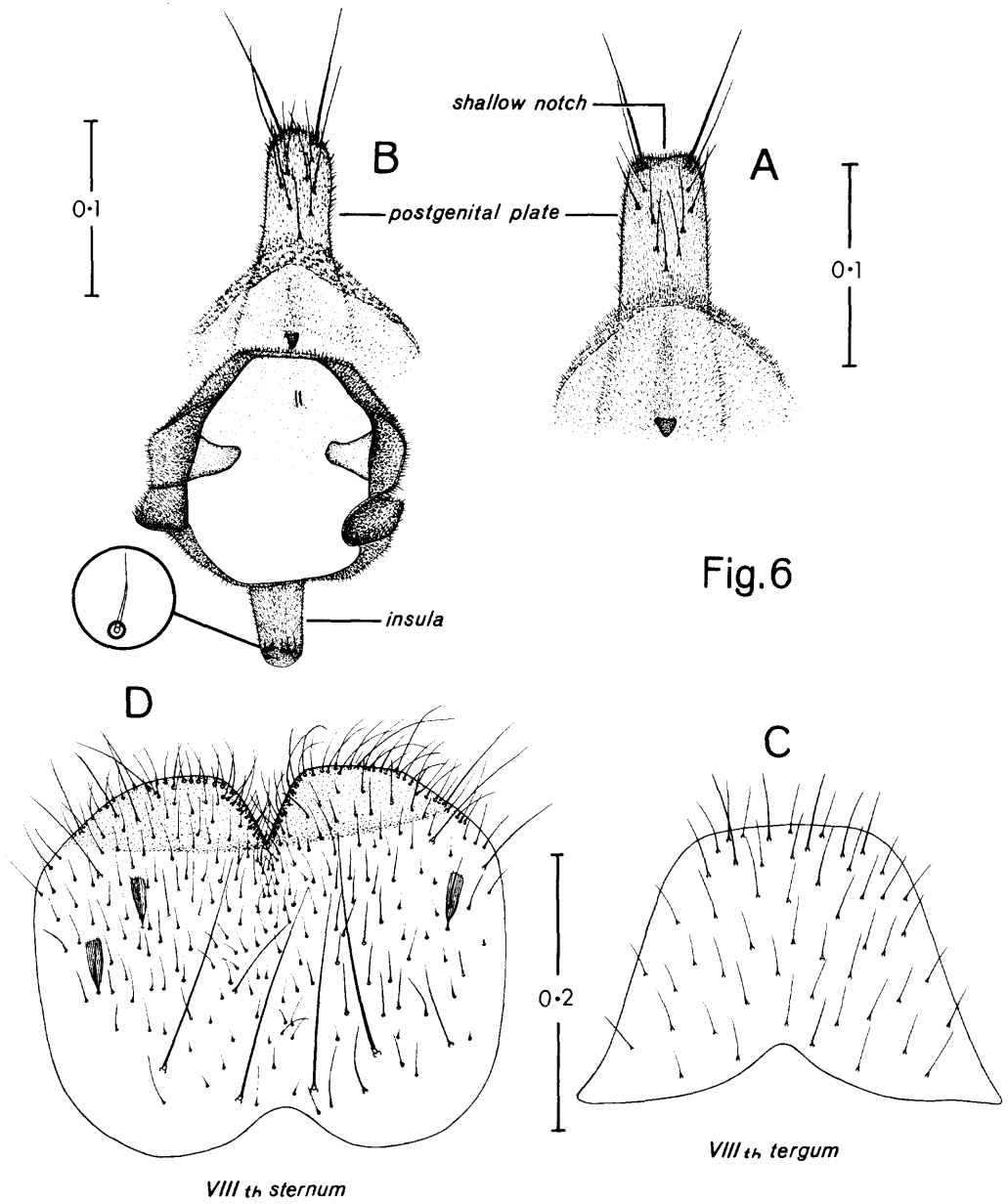
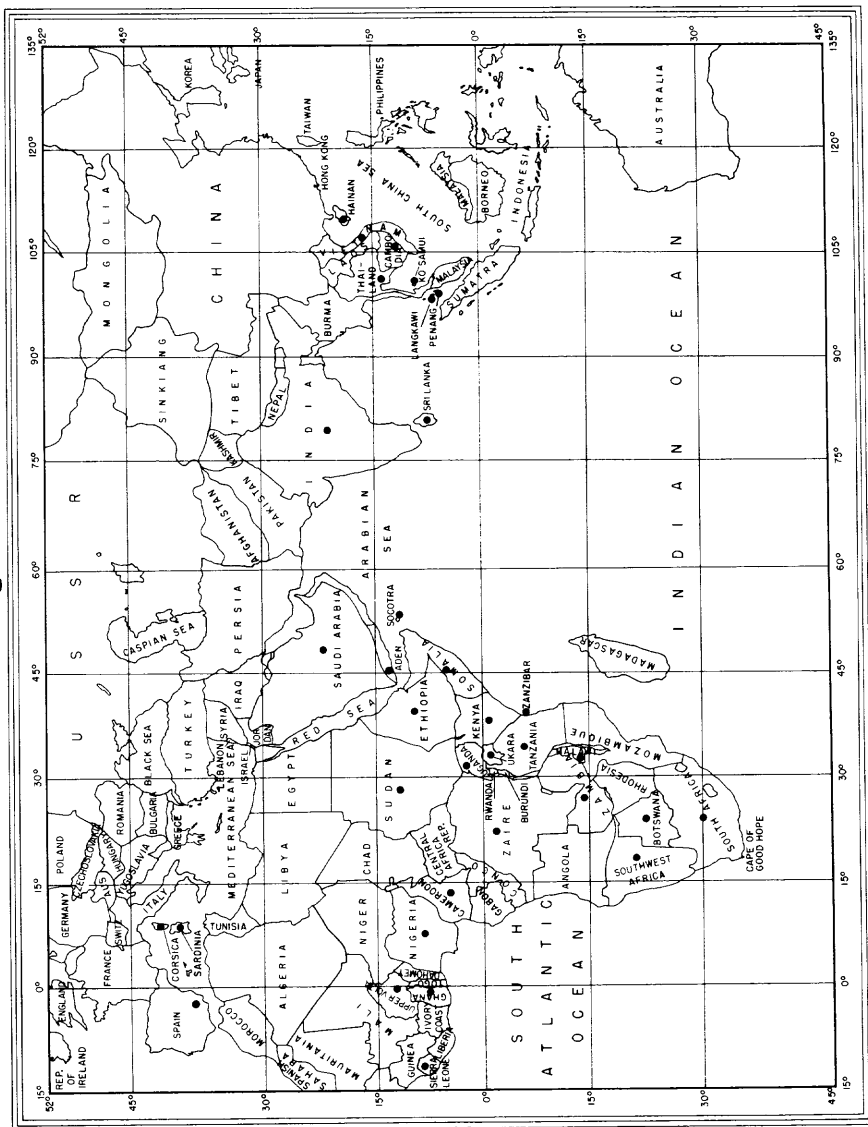


Fig.6

Uchai Malikul

Aedes (Aedimorphus) vittatus (Bigot)

Fig. 7



- Distribution of *Aedes (Aedimorphus) vittatus* (Bigot).
Based on specimens seen by the author.

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